The ELECTRICAL REVIEW

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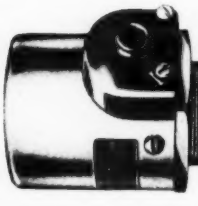

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The
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Methods of Barbarism!

IT is over 270 years since John Evelyn expressed a fine indignation at the pollution of London's air and the begriming of its buildings by smoke. During the intervening years the damage has immeasurably increased, while the public attitude towards it seems to have become more complacent.

This was natural enough so long as the burning of coal in small localised units provided the chief means of producing power for industry or for warming the homes and cooking the food of the growing population. Our fathers were forced to put up with a system that deprived them of sunshine and otherwise injured their health, and also imposed on them an annual tax of £1 per head in damage to materials.

We are bound by this necessity no longer, but we have not learned fully to profit by our freedom. In industry, while new works are being electrified almost as a matter of course, many thousands of horse-power remain unconverted to the electric drive, and we have taken little effective notice of such excellent examples as those afforded by New York and Vienna in restricting the use of steam locomotives.

The worst offender is the domestic hearth, on which at least one-fourth of our dirt originates, and which is the material source of tarry deposits that, with grit, sulphur and carbonaceous matter, are the main causes of the fouling of the atmosphere.

The development of a civic consciousness on the subject is likely to be slow, if past history is anything to go by. We therefore agree with the view, expressed by Mr. G. S. Francis, of E.D.A., in the paper he presented before the National Smoke Abatement Society last week, that the quickest way of getting something done is to appeal to the economic interests of the individual. There is little difficulty in gaining general recognition of the drudgery-saving and other qualities of electricity, but the incentive of lower costs is needed to overcome the inherent conservatism that makes people cling to out-of-date methods.

It was suggested by one speaker at the Smoke Abatement Conference that considerable alleviation would be obtained if as much thought were devoted to grit prevention as to the production of cheap steam. This, however, has been done. Dr. R. Lessing's paper showed that the effect of the gas-washing plant at Battersea and Fulham would be to prevent grit emission completely, and also to eliminate sulphur fumes by an amount equivalent to one-tenth of what is now in the air of London. Even at Tir John, in the smoky area of Swansea, similar arrangements have been made.

Thus the electrical industry may justly claim to be doing its full share towards superseding the present barbaric methods, and in two ways. It not only generates its product (at an expense that could only be incurred by working on a big scale) without causing offence, but it provides the best means of enabling others to do so. If we can persuade the public, for its own good, to make use of the benefits that electricity offers, less will be heard of the restrictive legislation that some foresee as the solution.

Is it Necessary?

WE recently recorded the registration of a company known as "The Electricity Consumers' Association, Ltd.," the objects of which were "to protect the interests of actual, prospective or potential consumers of electricity and power in Great Britain and the British Empire." The company has issued a pamphlet setting forth its aims, and is now enrolling subscribers (5s. per annum for householders and 20s. for all other classes of consumers) to enable it to carry on its activities. The programme is an ambitious one, albeit a trifle vague in parts, for we are told that the Association aims at becoming to the electricity consumer what the A.A. is to the motorist. Does this mean the setting up of an emergency repair service and the provision of a uniformed staff (instructed to salute all members)? It is proposed to extract from Parliamentary candidates pledges to press for the

standardisation of systems and charges if they are elected, and a "strong case" is being prepared for submission to the Government Committee on Electricity Distribution. Does this Association think that it can do more than the Electricity Commissioners and others are doing already in the way of speeding up change-overs and making other efforts to improve and extend the supply? And is it not attempting to anticipate the findings and recommendations of the before-mentioned Committee? We feel that we cannot hail the advent of the Association with enthusiasm, be its objects ever so laudable. Our fear is that it will merely complicate and confuse matters which are already in a rather tangled state.

Cheaper London Supply

WE reported a few weeks ago that the London Associated Electricity Undertakings, Ltd., had announced its intention of introducing two-part tariffs and hire-purchase schemes throughout the areas of its constituent companies. Now comes the welcome news that two of these companies have decided to reduce their flat rate for lighting from 5d. to 4½d. per kWh as from the Christmas quarter meter readings. In no part of the area will the flat rate then be more than 4½d. per kWh. The merger of the companies is thus being justified in the eyes of its consumers. This is only one of the movements for cheapening and facilitating supply which are going on all over the country, rendering a consumers' association a quite questionable necessity.

The Distribution Inquiry

SINCE the Minister of Transport announced in July the appointment of a Committee to inquire into questions relating to the distribution of electricity nothing further has transpired. But on Wednesday last the *Financial Times*, which is usually well informed, stated that the Committee was to hold its first meeting next week. According to our contemporary the proceedings will be private, and are expected to conclude by January. Although the task entrusted to the Committee is a most difficult one, we hope that it will be able to arrive at its conclusions quickly, so that the supply industry may know what its fate is likely to be.

The Session Begins

THE programmes of the institutions, associations and societies connected with the electrical industry and profession are now pouring in upon us, and it would appear that the coming winter is going to be a very busy one again. The list of functions received from the Institution of Electrical Engineers shows that Mr. J. M. Kennedy opens the session on October 24 with his presidential address, which we would expect to survey the present position of electricity supply and point to possible future developments. The papers down for the two following meetings deal with "heavy" subjects—Mr. A. L. Lunn, of the London Passenger Transport Board, is speaking on steel-tank rectifier sub-stations on the Underground Railways, while Messrs. T. E. Allibone and F. R. Perry are presenting a paper on the standardisation of impulse testing. The rest of the programme deals with "light-current" applications, the subjects being railway signalling (Major L. H. Peter), a cathode-ray oscillograph with high-speed drum camera rotating *in vacuo* (Mr. G. A. Whipple), the thyratron (Mr. A. L. Whiteley) and long-distance telephony (Mr. A. C. Timmis). After all this food for thought there comes the more tangible annual dinner on February 13th, and the session closes on April 23rd with the twenty-seventh Kelvin Lecture by Mr. J. D. Cockcroft.

Adaptability

DURING the last few years a remarkable change has occurred in the Ferranti business. From the earliest days of the industry the name had been associated with electrical equipment on a large scale—generators, switchgear, transformers—although the company's instruments were evidence of its interest and ability in less imposing work. The construction of the grid provided the company with a great deal of business which naturally fell in volume with the completion of the system. Then the company wisely commenced the production of "consuming" apparatus, such as fires and water heaters and, later, radio receiving sets. It was upon this side of the business that Mr. Vincent de Ferranti laid emphasis at the company's annual meeting last week. He also announced the company's intention of preparing for the advent of a public television service. Such adaptability to altered circumstances is a sign of vigorous life.

Watch the Removals

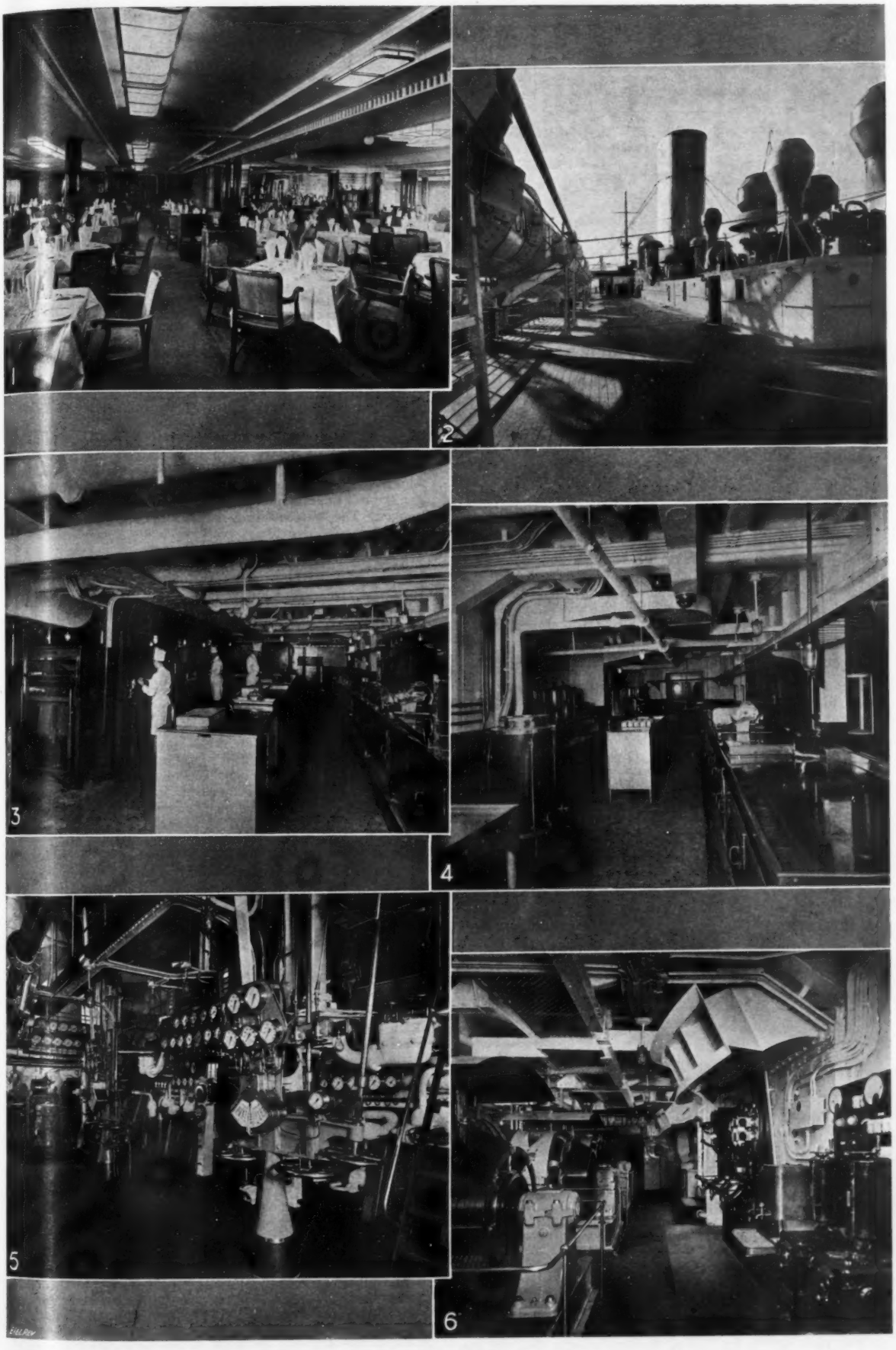
A CASE which has come to our notice recently raises a matter to which electricity suppliers would be wise to give their attention. A house which was originally equipped for gas was changed over by a wise owner to electricity. In the course of time he moved from the district and let his house to a man who knew nothing of the benefits of electricity or the best way of obtaining it. He made perfunctory inquiries about the price and found that the flat rate was so high as to preclude quite definitely the use of electricity for anything but lights, an iron and a radio set, and was persuaded by the local gas suppliers to restore the gas fires, etc., which were formerly employed in the house. Now, the local electricity undertaking knew that the house was being vacated, for the owner had given the required notice for the disconnection of his supply. Why didn't it, then, keep an eye on the place and send a representative to meet the new tenant on his arrival to explain the two-part tariff and other matters? A fully wired house has been practically lost to the undertaking. Is this happening elsewhere?

A.C. Flexibility

A CORRESPONDENT experienced in Indian conditions refers to the difficulty of securing adequate protection from shock for the domestic user in Bombay. The unusual humidity of the climate there is recognised by all who know anything of the city, and the position is made much worse than it need be by the low standard of wiring prevalent and the use of cheap fittings of non-British origin. Our correspondent's suggestion that transformation to a lower voltage would meet the case emphasises one of the most valuable features of a.c.—its flexibility, which enables the voltage to be easily adapted to the circumstances. Thus, even in Great Britain the employment of voltages less than the standard for portable lamps and appliances in the neighbourhood of metal and in building operations is advocated by the Home Office, but a.c. by means of the static transformer provides by far the best and simplest way of meeting such requirements.

Tinkering

WHILE only a very small proportion of the fires attributed to the "fusing of an electric wire" is found on investigation to originate in this way, the work of the handyman or the enthusiastic amateur is, nevertheless, a potential cause of trouble. Dr. T. F. Wall, addressing the Institution of Fire Engineers at Sheffield, suggested that the possibilities of fires being started by electricity should be subjected to a searching inquiry. He believed that a strong case could be made out for a more vigorous inspection of installations and for the prohibition of the employment of any but fully qualified craftsmen, both for new work and for repairs and extensions. Dr. Wall rightly equates extensions with the others, as the safety of many originally sound installations is seriously lessened by connections made by unskilled persons, as in the case which is referred to in our Correspondence section this week.



Some views of the s.s. "Strathmore." (See next page)

1. Dining saloon. 2. The boat deck, showing part of the ventilating system. 3 and 4. Views of the electrically-equipped galleys. 5. Instruments and controls in the engine room. 6. The generators and control gear.

THE largest and fastest vessel on the Europe-India service, the twin-screw turbine-driven steamer *Strathmore*, of the Peninsular and Oriental Steam Navigation Co., is to be put into service to-day, about five months after the launch by the Duchess of York from the Barrow yard of Messrs. Vickers-Armstrong. With a gross displacement of 23,500 tons and an overall length of 665 ft., the ship accommodates 445 first-class and 665 tourist passengers and carries a crew of 510. Her maiden voyage will be to Spain and Madeira.

The use of electricity for the hotel service is extensive and elaborate. Energy is supplied for this purpose and for the auxiliary machinery from three B.T.H. 550-kW d.c. 220-V generators driven at 500 r.p.m. through single-reduction double-helical gears by turbines running at 5,000 r.p.m. The latter are of the B.T.H. impulse type with stainless-steel blading designed for steam conditions of 400 lb. per sq. in. and 700 deg. F. Steam is taken from the main Babcock & Wilcox boilers. For emergency conditions an Allen 110-kW 220-V generator driven by a 165-h.p. six-cylinder Diesel engine has been installed on the upper deck.

The main switchboard is in three sections, each fed by a generator through a 2,500-A t.p. circuit-breaker and coupled together by 3,500-A d.p. switches. In abnormal conditions switches controlling feeders of secondary importance are tripped automatically. Current is distributed to thirteen auxiliary switchboards and also to important power and lighting services through d.p. circuit-breakers or switches and fuses.

Most of the motors are of the enclosed-ventilated drip-proof type. The forward windlass and the aft warping capstan

A saloon cabin showing the lighting and heating arrangements

operate on the Ward-Leonard booster principle. The former is driven by two 100-h.p. motors running at 375-1,125 r.p.m. and the latter by two 56-h.p. motors running at 350-1,500 r.p.m.

Eighteen sets of gravity davits for the lifeboats are installed, each driven by 15-h.p. motors, except that for the motor lifeboat, which is driven by a 35-h.p. machine. Twenty-two cargo winches are driven by 28-h.p. motors.

The Brown's electro-hydraulic steering gear is provided with telemotor and gyro-pilot control and is driven by two 50-h.p. motors which can alternatively be fed from the emergency switchboard. Two eleven-cell 128-Ah batteries provide current for the fire alarms, navigation telephones and other safety circuits.

The Cooking Equipment

Among the more important items of the galley equipment are a 14-oven island range, a two-pan fish fryer, two grills (one 12-kW and one 14-kW), a 28-kW double-deck bread oven and a similar bread and pastry oven, two 24-kW boiling tables for the native crew and two 4.4-kW Mohammedan and Hindu ranges. The water-heating equipment consists of ten 3-gal., one 5-gal., and one 10-gal. water boilers. A hotplate, griddle plate and waffle iron were also supplied.

Verity's electric fires with 1,000-kW "Chromalox" elements are installed in the public rooms. In the cabins the fires are of the portable 500-W type with "Staybrite" fronts and connected to interlocked switch sockets.

For the illumination of the public rooms concealed lighting with box-type fittings has been employed in most instances. Ivory roanoid fittings are used throughout the staterooms, passages and bathrooms. In the central dome and pillars of the first-class dance floor four-colour lighting is installed and the tennis court is floodlighted by five 500-W projectors. Altogether about 5,500 lighting fittings have been provided. A 20-in. searchlight projector will assist the vessel's passage through the Suez Canal.

Other electrical equipment includes a laundry, six lifts, fifty-one clocks, four systems of intercommunication telephones, a G.E.C. 25-V luminous call system (with two 1-kW motor generators and 1,200 push-buttons), a high-frequency echometer and telegraphs for docking and steering. The Marconi wireless installation comprises a 2-kW transmitter and receivers covering the range of commercial wavelengths, an emergency set working from an independent source of power, and two battery-driven lifeboat installations with searchlights. There is also a Marconi band repeater and music player and loud speakers with variable tone control.

The Responsible Firms

The contractors for the electrical equipment were: British Insulated Cables (cables); British Thomson-Houston Co. (floodlight projectors and lamps); Clarke Chapman & Co. (searchlight projectors, capstans and windlass); Chloride Electrical Storage Co. ("Exide" batteries); J. A. Crabtree & Co. (switches); General Electric Co. (cooking apparatus, indicators, fire alarms, fittings and lamps); W. T. Glover & Co. (cables); A. Graham & Co. (indicators); W. T. Henley's Telegraph Works Co. (cables); Johnson & Phillips (cables); Laurence, Scott & Electromotors (motors); Wm. McGeoch & Co. (fittings and indicators); T. Mercer & Sons (clocks); Metropolitan-Vickers Electrical Co. (generators and lamps); Siemens Electric Lamps & Supplies (lamps and telegraphs); Sperry Gyroscope Co. (steering equipment); Telephone Manufacturing Co. (telephones); Waring & Gillow (clocks); and Whipp & Bourne (switchboards).

A Corrosion-resisting Alloy

The following characteristics of "Tungum" alloy are taken from a pamphlet issued by Tungum Sales Co., Ltd. Melting temperature, 1,160 deg. C.; critical temperature, 840 deg. C.; thermal conductivity (c.g.s. units), 0.184 at 100 deg. C. and 0.246 at 900 deg. C.; electrical conductivity, 25 per cent. of that of copper at 100 deg. C.; equilibrium potential 0.272 V at 25 deg. C. against standard calomel electrode; magnetic susceptibility, minus 0.08×10^{-6}. "Tungum" is said to be practically unaffected by sea-water and to be highly resistant to other corrosive agents, impact and fatigue.

Electric Ploughing. By E. D. Davies, B.Sc.

French practice and British prospects

DR. DENHAM in "A Review of the Progress of Electrification in Modern English Farming Practice," published in the June number of the *Journal* of the Ministry of Agriculture, touched on many important aspects of electro-farming, and one in particular in which I am interested—electric ploughing. Dealing with this subject Dr. Denham says: "The employment of electricity for ploughing has been confined to a few enthusiasts in this island, and cannot compete on equal terms with the tractor. On the Continent and in North Africa, however, under less stringent wiring regulations, electric ploughing gear, consisting of motor-driven winches and gear similar to that used with the by no means obsolete steam plough, has made remarkable progress, and is in extensive use on some of the larger development schemes in Italy."

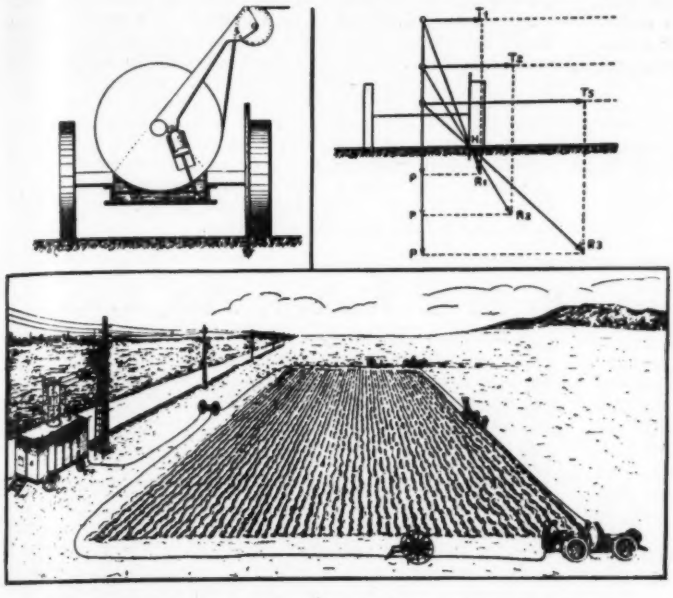


Fig. 1.—Diagrammatic representation of the "Estrade" system

In the districts surrounding Paris, ploughing by electricity has been adopted, 45,000 to 50,000 acres having been so ploughed in the last ten years. In the north of France some attempt at generalising this practice has been made by the Société pour les Applications de l'Electricité, a subsidiary of the distributing company for the Valenciennes-Cambrai-Anzin district. This company introduced in 1928 a system of ploughing under contract for the local cultivators (in particular, the sugar-beet cultivators of the Cambrai region) at a fixed rate based on a minimum of 250 hectares (617 acres) yearly, portable units which can pick up current from the existing 15,000-V lines being employed.

So far as I am aware no electric ploughing gear of this description has been used or imported into this country, but there is no reason why it should not be tried in Southern and Eastern England. Now that the sugar-beet industry is more or less established in this country, farmers will want to improve their crops by ploughing deeper, and it is here that electric power will become extremely useful. A few remarks may give the necessary impetus and galvanise into activity some of our more enterprising farmers and large cultivators.

Advantages of the Electrical Method

Electric ploughing has a direct advantage over the tractor in that ploughing can be proceeded with when the ground is soft, and although the steam winches have a certain advantage over the tractor in this respect, the steam plant is heavy and immobile, it cuts up the fields, and requires much attention. The winch driven by the internal combustion engine is very light and mobile, but in France the high cost of fuel prohibits its use. Nevertheless the electric motor is superior.

Another advantage of the electrical method over the tractor is that the complete output of the electric motor is used solely to draw the plough, whereas with the tractor power has first to be expended to move it. Even on level ground, generally similar to stubble in good ploughing condition, the wheel slippage is between 7 and 16 per cent. so that it can be imagined what it would be like under worse conditions. In addition the maintenance and wear and tear is much heavier in the case of the tractor, and this is an important consideration in the country.

There are many types of electric ploughing gear employed in France, and there is one in particular, which is worthy of description, the "Estrade" outfit made by the Alsthom concern, Paris. It is very light, can move under its own power, and is able to draw an enormous load. This has been achieved by increasing artificially the weight of the windlass to prevent it from overturning. This windlass which weighs only 4,500 kg. can develop on the cable an effort equal to an ordinary windlass of 14,000 kg.

The traction cable is wound on a drum, with its axis horizontal, and is carried over a pulley fixed at the extremity of a jib which rotates about the same horizontal axis, The rotation is due to inequalities in the resistance of the ground, which increases or decreases the tractive force on the cable. The jib is connected to two oleo-pneumatic pistons, similar in design to the oleo leg forming part of an aircraft undercarriage.

When the cable is under a tension T2 (see fig. 1) the resultant of the weight P and T2 displaces itself, so as to pass through the inside edge of the wheel rim, fitted with discs. The vertical component of the resultant, is always equal to the weight of the windlass, and is transferred to the ground through the wheels, which are designed for that purpose. That is, the width of the wheel is such that the bearing load is within what the ground can safely take. Similarly, for other values of the tractive force. These conditions, when fulfilled, guard against the windlass overturning. Fig. 2 shows the system in operation.

In order to prevent the windlass slipping or rather to give it adhesion as the plough is drawn, the ratio of the depth of disc to the width of wheel is so arranged that the "prism" of earth thus formed will resist this tendency. The application of these principles enables a windlass to be designed, which has a tractive pull equal to 50 per cent. of its own weight. This is obviously lighter than the types which rely on their weight alone against overturning and slipping. The oleo-pneumatic piston, which is primarily adopted to assist the anchoring of the windlasses, also damps the shocks produced by unequal resistance of the soil and enables a steady pull to be applied to the plough.

The conditions necessitate a special type of motor to meet the requirements—robust, simple to operate and easy to maintain. The makers have installed an induction motor, double wound, 45 h.p., 500 V, with a star-delta starter. The stator is wound for four and six poles, giving two speeds of ploughing, *viz.*, 120 metres and 80 metres a second. The other motor, the "moteur de translation," is for moving the windlass forward as ploughing proceeds, and is similar to the above mechanically. The rotor is double wound to enable the windlass to be moved forward or back, by a simple operation; brakes are fitted.

The high ploughing speed, 120 metres per sec., gives a tractive force of 2,250 kg. (5,000 lb.), which is the normal output of the motor at this speed; it can be overloaded to 2,700 kg. The low speed (80 metres per sec.) gives a pull of 3,400 kg., which can be increased in emergency to 4,000 kg. (4 tons).

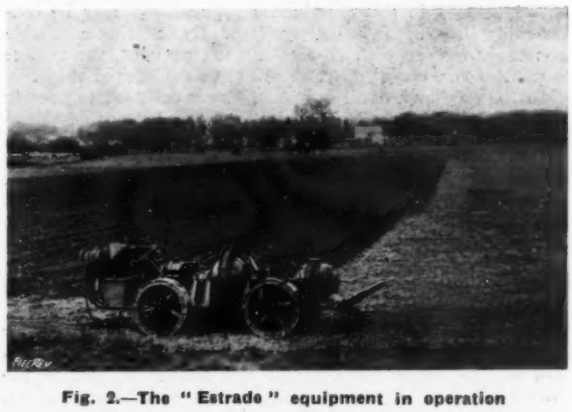


Fig. 2.—The "Estrade" equipment in operation

A portable transforming station consists of an oil switch,

with protective devices, potential transformers and a three-phase, 15,000/630-500 V, 50-kVA main transformer. The main transformer is connected through the oil switch direct to the overhead line air-break switch. The pressure is regulated to give 500 V at the motor terminals.

In order to permit ploughing to proceed two hours before daybreak and in the evening the plough is equipped with two acetylene flares, which illuminate the route. A 12-V supply from an auxiliary transformer in the cabin feeds an electric projector at each windlass, in order to light up the region where the plough tilts over at the end of the furrow. A barreter tube is connected in the secondary circuit to regulate the current to the projectors, which would otherwise be subjected to an irregular potential, as the result of varying load. The cabin is normally equipped with 2,000 metres of three-coil 20 sq. mm. cable, which permits work to be carried out at 1,300-1,400 metres from the transforming station.

The personnel consists of one man on each windlass, and a man on the plough, who transmits orders by arm movements, light signals, or by shouting. These men sleep in a van.

A balanced two or three furrow plough is employed, and is tilted by displacing its centre of gravity. The two windlasses are placed approximately 400 metres apart. When the ground is stony and heavy, it is necessary to plough slowly using two shares, and 2 hectares (5 acres) can be ploughed in 10 hours. If the ground is normal 3.5 hectares can be ploughed to a depth of 20-25 cm.; or 2.6 hectares to a depth of 30 to 35 cm. (13¾ in.). The plant can also plough a furrow 70 cm. deep, using one share.

The consumption per hectare (2½ acres) varies according to the depth of ploughing and the resistance of the ground, and is between 50 and 120 kWh; the daily consumption is 150 to 200 kWh; and the average consumption for ploughing 1,000 hectares (2,500 acres) *annually* works out at 25 kWh per hectare or 10 kWh per acre. The windlass motors can also be used in position for thrashing, and for other heavy work. Electricity for ploughing is sold at 0.75 fr. per kWh.

It would appear that French agricultural engineers are more enterprising than the British, and that the French distribution companies are doing everything to provide the farmer with an abundant supply of electricity. A French farmer has told me that it is almost impossible to find a village, however small or remote, that has no electricity. Why is it that in France development has proceeded at such a pace? Is it only because the wiring regulations in that country are not so restrictive as in Great Britain? In other words are the wiring regulations in this country a stumbling block?

For electric ploughing to be adopted in this country, there would have to be more power lines working at high pressure erected in the rural areas; these lines could be easily tapped for a supply to portable transformers. Power would also be available for the development of electricity on the farm. Undoubtedly the best system would be that adopted in France—ploughing under contract, with a crew of trained men in charge. Another scheme would be for the interested farmers to co-operate in order to provide the necessary funds, and a suitable basis for contributions would be the area of cultivated land farmed by each participant.

The Resonant Circuit.

By E. C. Wadlow, Ph.D., B.Sc.

THE usual method of obtaining voltage step-up with a.c. is by means of a transformer, but for small apparatus this method is sometimes unnecessarily complicated and expensive. Advantages are obtained by using instead a simple resonant circuit incorporating a condenser in series with the component which requires an operating voltage higher than that normally available. This method is not frequently used in practice, but the theory is described in all text-books on alternating current.

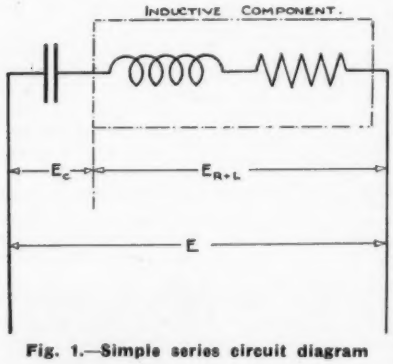


Fig. 1.—Simple series circuit diagram

In a simple series circuit consisting of a component having resistance R and inductance L in series with a condenser of capacity C the voltage across the former is $E_{R+L} = I\sqrt{R^2 + (\omega L)^2}$, while the voltage across the condenser will be

$$E_c = I\sqrt{1/(\omega C)}, \text{ and } I = E/\sqrt{R^2+[\omega L - 1/(\omega C)]^2}$$

The current I reaches its maximum value when $\omega L = 1/\omega C$ and in this case both E_{R+L} and E_c may be considerably above E, the supply voltage. By selecting a suitable condenser for use with the inductive component, the voltage across the latter may often be raised to the desired value.

In the case of a small induction motor designed to operate at between 200 and 250 V the ratio of the torques developed on highest and lowest voltages was approximately 1.56:1. Having to perform a duty which it was incapable of doing at less than 230 V and as it was desired to keep the motor standard in every way and not to make up special equipment, the series resonance method was tried. It was found that by connecting 2.4 mF. in series with the motor the voltage across it could be stepped up to 230 V with a 200 V mains supply and to 250 V with a 220 V supply. For mains voltages of 230 and upwards the condenser was not required.

In another instance it was desired to use a standard motor at Continental voltages between 130 and 160 V. The standard voltage ranges were 100-130 and 200-250 V, and as the motor might still be called upon to work within these ranges, re-winding was not permissible. The voltage could have been reduced from, say, 150 to 110 V by means of a choke, a resistance, or a transformer, but it would have been necessary to design and make up specially whichever of these units had been selected. It was simpler and cheaper to resonate with a condenser and use the motor on the 200-250 V range. With a 3 mF. condenser 200 V across the motor could be obtained with 135 V mains and 240 V with 160 V mains.

The method also provides a useful means of power factor correction when using an inductive load with VA definitely limited. Thus, a phonic motor which could be run from a valve oscillator at 245 V took 0.051 A, 10.2 W, 12.7 VA, but by resonating with a 1 mF. condenser in series with the motor it was possible to obtain the same voltage across the motor (and hence the same power output) with a supply voltage of only 200, the total consumption then being 0.052 A, 10.2 W, and 10.4 VA, a reduction of 2.3 VA.

The method, however, has limitations. For instance, it can only be used with an inductive component. If the load is entirely resistive, a higher voltage can be obtained only by employing a transformer. The ratio of supply voltage to maximum voltage possible across a component of resistance R and inductance L is, in fact, given by the term $R/R^2+(\omega L)^2$.

This expression also represents the power factor of the component. Also, since $\omega L = 1/(\omega C)$ at resonance, when maximum voltage across the component is obtained, the size of condenser required is inversely proportional to the inductance of the component. Thus the method is most advantageously used with components of low power factor and high inductance. Most small induction and synchronous motors, such as are used in clocks, gramophones, time switches, etc., fulfil these requirements.

In order to utilise the most economical size of condenser it is necessary to work on the steep side of the resonance curve where a small change in capacity produces a considerable change in voltage across the component. On this account it is desirable that the value of capacity required should either be checked by measuring the voltage obtained or else determined experimentally in the first instance.

If the value is calculated, it should be noticed that the effective resistance R is not necessarily the d.c. resistance of the coils on the component. Thus, in a small squirrel-cage induction motor having shading rings for phase splitting purposes the d.c. resistance when hot was about 760 ohms, but at 200 V, 50 cycles the value calculated from current and power measurements was about 2,250 ohms. The latter figure is the one to be taken if the value of capacity required is to be calculated. Another error may result if the effective resistance is calculated for the supply voltage and not for the maximum voltage to which the component will be subjected in the resonant circuit. The power factor of most components changes slightly with applied voltage.

At resonance the voltage across the condenser is theoretically equal to that across the component, and is thus obtainable from the fourth equation. In practice the peaks in the voltage curves for condenser and component do not occur at the same value of capacity. This feature is caused by the presence of resistance in the circuit.

Desirable Precautions

With this method very high voltages may be obtained across components of low power factor, and care must be exercised to avoid voltages which are likely to cause damage to the component and the condenser, and also to avoid shocks which might result from careless handling. Measurement of the

voltage across the component and the condenser must always be carried out with an electrostatic voltmeter. Other types, such as moving voltmeters, give results which may be grossly in error if the meter is used only for checking purposes and is then removed. The voltages across both branches will be considerably under-estimated.

Although the application of the method for obtaining increased voltages only has been described, obviously the voltage can be lowered in a similar way, and the same general remarks apply. In this field the method has to compete with the use of resistances and chokes. As the operating point on the resonance curve is further removed from the peak value when the voltage across the component is to be reduced, the power factor of the circuit as a whole is also reduced. On the other hand, the value of capacity required to reduce the voltage is always less than the value which is required to raise the voltage.

However, the basic advantages may still be considered as remaining unchanged, namely, the voltage is increased or reduced by using a component which itself consumes no power, and therefore has no heat to dissipate, and, further, any desired value of capacity for use with small components such as those described can be built up quickly and cheaply from the wide range of sizes which is now generally available.

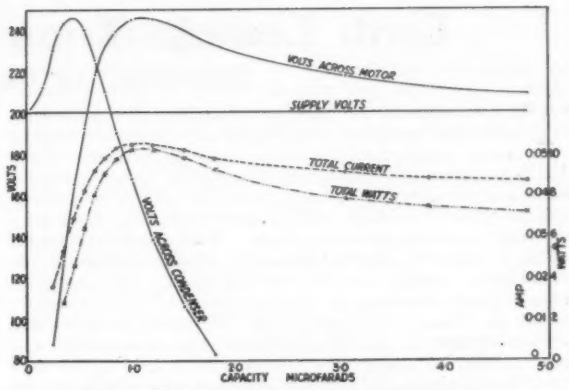
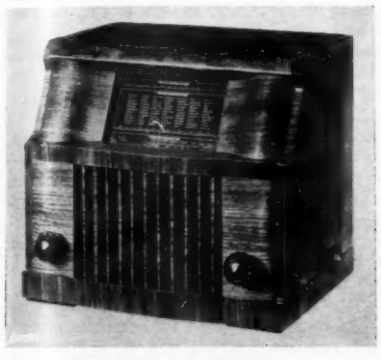


Fig. 2.—Typical small motor resonance curves

The Paris Radio Show

IN spite of the crisis of which one hears so much in France at the moment, the Salon de la T.S.F. (Paris Radio Show) was as great a success as ever. Some 225 firms showed sets, most of them of French manufacture, although the usual foreign makers were also represented. As might have been expected, there is little serious change in the sets shown. Radio progress seems to have arrived at a saturation point at which little more need be done. This situation is not displeasing to the makers, as it permits them to develop the manufacturing side of their plants instead of having constantly to change their designs.



The Loewe "Ambassador"

There are, however, some general changes in the tendency of most of the sets, and a few novelties. One of the most noticeable things about the show, for instance, was the use of the word "Transcontinental" everywhere, almost all the makers having gone in this year for short-wave bands on their sets. Variations of arrangement or improvements in the cabinet making with a view to better tone quality were also to be seen, this matter of tone being the main concern of the makers at present.

Only one maker showed a television set, although several manufacturers of parts displayed cathode-ray tubes, and could be persuaded to tell inquirers that these could be used for the making of television receivers. The present policy of French radio interests is not to push television, as the first flurry of interest in this subject last spring resulted in a sudden sharp decline in radio business, the public fearing that anything they might buy would be out of date as soon as the television sets came on to the market.

A good many more anti-parasitic filters were to be seen, but the manufacturers are making less of them than formerly, as they have become rather a habit with the public. More was to be seen, however, of the proper way to use them, as makers have found that they are frequently improperly installed, and so fail in their aim.

Among the novelties there was an interesting change in the new "Jupiter" sets. Working on the principle that much of the distortion in a loud speaker comes from the Larsen effect on the valves and from the reflection of sound from various parts of the apparatus, this firm has separated the speaker from the set. It is arranged in a separate compartment placed generally below, although in one or two models it is above, the set proper. The compartment is built of heavy wood so as to reduce the probability of its being able to vibrate. The loud speaker is about half way back in the sort of tunnel thus formed, and suspended by thick felt. This arrangement is effective in obtaining pure high notes.

One or two models of the Ducretet sets are equipped with "Dynharmonic" loud speakers in an enclosed case from the top of which a number of pipes project, similar to those of an organ. The lengths of these pipes are so arranged that they will reinforce most of the notes of the loud speaker, although in the small models for home use it is not possible to get all the reinforcement one might wish of the lowest notes. The improvement is, however, marked, much of the scratch and some of the parasitic noise being removed. A disadvantage is their rather large size.

In the "Miracle" sets tuning is connected with a gyroscopic regulator arranged with a reducing gear, so that very delicate adjustments are obtainable. To avoid the disadvantage of slow and tedious change from one end of the dial to the other the gyroscope is installed. Operation consists simply of starting the control button by a single twist. Without further turning of the button the controls will continue to turn and have only to be stopped when the desired point is reached. Fine tuning is then obtained in the ordinary way. Another advantage of the gyroscope is that it prevents vibration upsetting the tuning.

The new Loewe "Ambassador" is a superheterodyne with four valves, two of which are multiple. It includes six circuits and, like most of the sets on show, will receive anything from 20 to 2,000 metres. It is equipped with the anti-fading arrangement now to be seen generally, except on the cheapest sets. Another good set is the "LL Supervox" 200 to 2,000 metre five-valve superheterodyne all-mains set. The tone control is arranged so as to give protection against parasitic noise. The dial is typical of one of the general changes. It is of what the French call the "aviation" type, like a clock, the indicator going around like the hands. It is also in several colours to facilitate the reading of the names of the stations on the two bands of wavelengths.

The L.M.T. "baby grand" set

An L.M.T. set, which has not as yet been put on to the market but is to be ready in about a month, is in the shape of a small grand piano about 3 ft. long. The place of the keys is taken by the controls of the set, and the loud speaker is put in the top under the lid, which is raised to throw the sound out into the room. The lower part of the "keyboard" pulls out and is installed as a pick-up for records. The set is a nine-valve compensated superheterodyne. The loud speaker is arranged with "harmony tubes," large tubes which run through the baffle board around the loud speaker and let out the high notes from the back of the cone as well as from the front. The medium and low tones are muffled by an arrangement of acoustic material behind the loud speaker.

Earth Leakage Trips. By T. C. Gilbert, A.M.I.E.E.

Inadequacy of the I.E.E. Regulations

THE columns of the ELECTRICAL REVIEW have on several occasions contained expressions of opinion by experienced contractors in criticism of the tenth edition of the I.E.E. Regulations. The volume of criticism has undoubtedly been intensified by the recent unfortunate issue of alterations and amendments, which tend to make confusion worse confounded, according to some writers. Most of such disparagement is, however, directed towards alleged ambiguity or redundancy, contradiction or over-elaboration, and practically none towards attacking the technical effect of any regulation, unless it be that unfortunate 1002 (B), which requires the interconnection of electrical conduits with metal baths and gas geysers. Had this been thrown overboard in the new amendment sheets, I believe that not a single voice would have been raised in protest.

It therefore falls to me to raise a point which I had hoped would have received early attention in the very first issue of any amending publication, but which seems to have escaped notice in the general welter of less important matters, and in the achievement of correct and legally infallible phraseology.

In spite of long-standing propaganda by means of articles in the technical Press, public debates and actual demonstrations, some of which were made to the Wiring Regulations Committee itself, this Committee, incredible as it may seem when its constitution is taken into account, has completely missed the boat with regard to earth-leakage protection as effected by means of earth-leakage trips.

Practically Valueless

The Regulations as they stand are practically valueless in this important respect; worse, they open the way for a complete misapprehension of the whole question and the early introduction of unsuitable apparatus. Regulation 1005 (C) states that where it is economically impracticable to obtain an earth having a resistance of not more than one ohm, then earthing shall be supplemented by an earth-leakage trip so adjusted that it will operate at not more than 30 mA. Leaving out of the question the mystifying effect of the word "supplemented," which has been gravely debated on more than one occasion but upon which the Olympians have so far vouched no verdict, how far does this requirement get us towards improved earth-leakage protection?

In the first place the problem confronting the installation man is to protect the public adequately against dangerous leakage *potentials*. No casing surrounding electrical apparatus must possess a potential likely to be dangerous or even annoying to the user, and the high-resistance earth connection is rightly frowned upon because of its possibilities in this direction. The note to Regulation 1005 (D) apparently visualises that the safe limit to leakage potentials is 50 V, and it might, therefore, be thought that some effort would be made to ensure that such limitation was assured by means of the only system capable of securing it.

The regulation concerned, however, is feebly content to limit the leakage *current*, which is of secondary importance only, and really has a subsidiary bearing upon the main problem. Under present conditions and requirements inexpensive earth-leakage switches can be manufactured in compliance with the regulation to operate at 30 mA, but possibly they will not do so until the casing of the connected apparatus has reached a potential of 50 to 100 V above earth.

Low-leakage currents are employed for protection in leakage trips because heavy currents over high resistances must entail high leakage potentials, but such high potentials may also be caused by reason of small currents flowing through high-impedance trip coils. Anyone can design a leakage trip to sell for a few shillings if no limit be placed upon the operating voltage, as the trip coil may be of some hundreds of turns of very fine wire in order to produce the requisite effort; but such coils cannot stand up to practical requirements.

A German Example

In many cases currents of 100 to 500 mA would not produce a dangerous potential. Any regulation dealing with earth-leakage protection, whether by solid earthing or by leakage trips, should be designed with the main point in view, namely, the elimination of dangerous leakage potentials. As the potential arising from earth leakage is entirely dependent upon the resistance of the earth circuit, it would be necessary, in order to secure the production of effective apparatus, merely to state that an earth-leakage trip must operate at a predetermined potential against specified earthing resistances, the minor consideration of operating currents being omitted.

I would point to the corresponding regulation as found in the requirements of the V. D. E. regarding earth-leakage trips. It will be generally agreed, I think, that we may safely take the German engineers' lead in this matter, the leakage trip having been designed and developed in Germany, and there is no doubt that the regulation effectively meets the case. It reads:—

> With a resistance of 200 ohms in the artificial earth circuit the switch shall trip at a potential of 22 V, plus or minus 2 V. With a resistance of 800 ohms in the artificial earth circuit the switch shall trip at a potential of less than 65 V.

Nothing could be clearer, and there would be no possibility, under this rule, of the introduction of inefficient apparatus operating at a current of not more than 30 mA, but possibly at a potential of 100 V. Such apparatus could, with justice, be claimed to be in accordance with our Regulation 1005 (C).

It should be pointed out that the resistances stated in the above rule are those due to the earth leads and the earth electrode, and are over and above any impedance due to the trip coil itself. German apparatus constructed to these requirements may operate at 50 or 60 mA, permitting robust construction and complete freedom from trouble. The average operating voltage on simple electrodes is from 20 to 24 V, coil impedances ranging from 500 to 600 ohms at 50 cycles.

"Decidedly Feeble"

We must endeavour to obtain something on the above lines incorporated in our I.E.E. Regulations before the problem can be considered to be adequately dealt with and, I think, with all due respect to the compilers, that this should have been foreseen by them. Even after making full allowance for the fact that the method of protection is new to this country (or was, three years ago, when first presented to the Wiring Regulations Committee) it cannot be claimed that the Olympians' treatment of the matter is other than decidedly feeble and must be criticised on the grounds of encouraging the production of inefficient, if not dangerous, apparatus.

An earth-leakage trip made in this country in accordance with the I.E.E. Regulations operates efficiently at 28 mA, but when the test key is depressed the metal housing of the switch is completely isolated from the earth electrode and left unguarded against leakage potentials. As the person operating the testing device can hardly fail to be in intimate contact with this unearthed metal casing, the possibilities of shock in the event of insulation failure in the test circuit are obvious. The Regulations should require that all leakage trips equipped with test keys must be housed in non-metallic casings, unless the defect mentioned above can be got over in some other way, or, alternatively, that another leakage trip should be fitted farther back in the circuit to which this metal casing can be connected for protection. These simple points are standard Continental practice, and must obviously be followed in this country.

Should an accident of the nature visualised above occur, earth leakage-trip protection would be discredited in this country, and the responsibility could only lie with the lack of vision of the legislating body. It is, I suppose, gratifying to find that the tenth edition permits earth-leakage trips at all, for we must not expect everything at once, but the matter will have to be dealt with in a much more complete and efficient manner if the full benefits of leakage protection by this method, in which some of us place great confidence, are to be secured.

A Suggested Substitute

Luckily, present users of the method in this country seem to be much more *au fait* with its requirements than do the Wiring Regulations Committee, so that no great damage has as yet been done. May we hope that a further amendment sheet will be issued in which the present casual Regulation 1005 (C) will be replaced by another, designed to set out adequately the basic principles of earth-leakage protection by means of earth-leakage trips, and thus secure the full benefit, namely, the complete elimination of the dangerous leakage potential from our installations.

Although leakage trips are legislated for in the tenth edition, no modification has been allowed as regards earth conductors when these devices are used; it is still apparently necessary to make the earth conductor at least half the size of the cables in the circuit. This is obviously unnecessary, and several insertions of the words "except when used in connection with earth-leakage trips" are required in the clauses dealing with earth conductors. The only consideration required for earth conductors in connection with leakage trips is that of mechanical strength, under particular conditions of usage, and in the interests of economy this should be made clear.

District Heating Stations

The transmission of steam and hot-water in Switzerland

THE beginnings made in Switzerland with combining the production of heat and electrical energy in district heating power stations point to the probability of further satisfactory development. The full output of hydro-electric power stations is possible only during summer, but power required at times of water shortage can be provided by thermal plant or hydraulic accumulator stations. If a district heating power station forms part of the scheme, electricity is generated at the point of use at low voltage, thus saving transmission losses, and the cost of fuel burned for this purpose is only a small proportion of the whole.

At present there are only two public district heating power stations, both in Zurich, namely, that of the Federal Technical University and the municipal refuse destructor. These are in the town itself and serve districts close to, but independent of, each other. The object of the University was to provide a plant which would serve also for instructional and research purposes for the engineering department, whereas the refuse destructor plant was designed to dispose of the rubbish of the town in a hygienic and economical manner. A large number of buildings belonging to the canton and the federation are here close together and are supplied with

ANNUAL CONSUMPTION OF HEAT IN THE UNIVERSITY SYSTEM.

	Central heating. Kilo-thermies.	Heat for other requirements.		
		Steam. Tons.	Hot water. M³	Total Thermies.
University buildings	8,870	1,200	4,000	980,000
Cantonal hospital	3,510	6,000	22,000	3,600,000
Administrative building (Kasp. Escher)	3,700	—	—	—
Private houses	1,920	—	8,000	520,000
Totals	18,000	7,200	34,000	5,100,000

1 thermie = 1,000 calories and 1 kilothermie = 1,000,000 calories.

water for central heating and for technical purposes, and also service water. Many private houses are also connected to the plant.

The thermal connections in the University station are complicated by the necessity of working with four steam mains of different pressures. On the water side, different heating systems were provided to meet the requirements of the consumers and because of the varying levels of parts of the district. The station includes a Sulzer mono-tube steam generator working at 100 atm., a water-tube boiler at 35 atm., a primary turbo set for 100 atm., a back-pressure and extraction turbo-set and a condensing and double back-pressure turbo-set. One particularly interesting feature of the installation is the use of electric boilers for raising steam to meet the smaller demand for heat in summer. In 1933 the University supplied 1,720,000 kWh to the municipality of Zurich and received 4,520,000 kWh. It produced 20,500,000 thermies from combustion and 3,500,000 thermies by means of the electrode boilers.

At the destructor plant, although the quantity and calorific value of refuse are less in summer than in other seasons, the daily output of electricity is greater on account of the smaller demand for heat. In this station there are two boilers with a heating surface of 540 sq. ft. each and two condensing and extraction turbo units.

The steam power station of Pierre de Plan at Lausanne is now being reconstructed. Up to the present this station has been equipped both with Diesel engines and steam plant. Steam at 170 lb. per sq. in. was used in three condensing turbines and the plant was run only in emergency. In the immediate neighbourhood of the power station is the cantonal hospital, which requires a considerable quantity of heat in both winter and summer and has hitherto been supplied by various boiler plants in the building. The new scheme involves the installation of a Sulzer boiler (640 lb. per sq. in.). The additional heat drop obtained is to be utilised by passing the steam through a primary turbine, the exhaust from which will go partly into the existing condensing turbines for generating electricity and partly into steam transformers for

REFUSE DESTRUCTOR SYSTEM.

	Spring.	Summer.	Autumn.	Winter.
Refuse received :—				
Quantity in tons per day	95	83	95	118
Calorific value, in calories per kg.	1,150	800	1,150	1,450
Electric energy generated :—				
Total kWh per day	4,750	4,685	4,280	3,950
Required in the works per day ...	2,520	1,880	2,110	2,980
Balance available	2,230	2,805	2,170	970

Total annual production about 750,000 kWh.
Central heating (requirements at −20°) 6,000 thermies per hour.

raising the temperature of water required for central heating. Here, also, an electric boiler will be used in combination with a steam accumulator, so that considerable surplus energy can be used for producing heat under certain conditions.

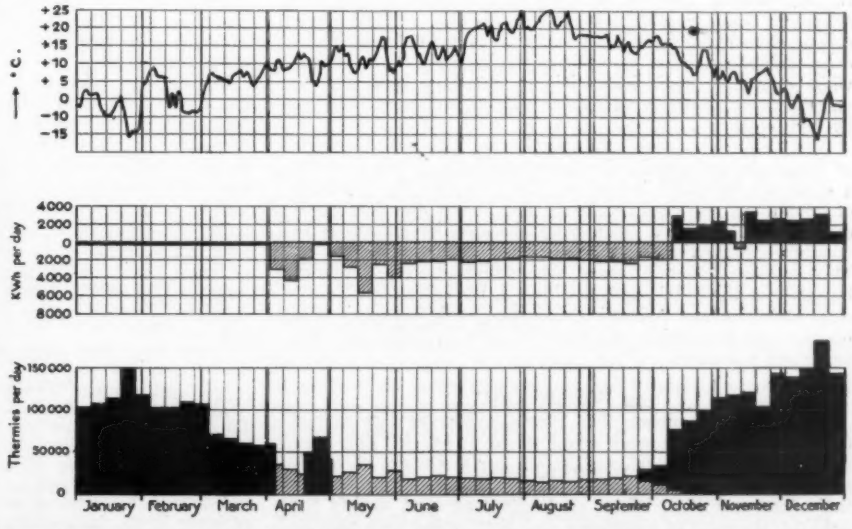
The feasibility of developing district heating power stations depends in the first place on the price obtainable for heat. The method of calculating this differs from that used for ascertaining the price of electricity, since it is not the cost of distribution and losses but the cost of producing the heat *ex* works which plays the most important part. The consumer can produce heat himself by means that are simple in comparison with those required for generating electricity, so that only a small margin is available in determining the selling price of heat, and the scope of stations supplying heat is limited.

The tariffs are not drawn up with a view to increasing consumption in accordance with productive capacity, as in the case of electricity, but to take account of the greatly varying cost of producing the heat so that neither the consumer nor the supplier of heat suffers loss through unforeseen occurrences. The cost of producing the heat is composed of a fixed part and a part which varies with the quantity produced. While the fixed costs as a rule vary little in the course of time, the running costs alter not only with the quantity of energy produced but also with fluctuations in the price of fuel.

COST FIGURES.

Number of degree-days.	Fixed tariff Sw.fr. per annum.	Variable tariff in Sw.fr. per annum according to the retail price of coke per ton of :—					
		55	60	65	70	75	80
2,710	350	600	655	710	760	810	865
2,970		660	715	775	835	890	950
3,230		720	780	845	910	970	1,035
3,490		775	840	910	985	1,045	1,115

In Switzerland the following methods of selling heat are in use. The quantity of steam or hot water supplied to large consumers is determined by individual meters and charged on a two-part tariff. The fixed part corresponds to the costs of keeping the heat ready for use and the variable



Top: Daily mean external temperature in 1933. Centre: Exchange of electrical energy between the University power station and Zurich Municipality (black, energy sent out; hatched, energy received). Bottom: Hot water and steam used (black, from local combustion; hatched, from electrode boilers)

part to the cost of fuel per million heat units supplied. Small consumers are not usually metered independently, several houses being supplied through one heat meter. The quantity recorded is then divided between the different consumers in the group in proportion to the heating surfaces of the radiators installed. The rate of payment is determined in a manner analogous to that used for large consumers, except that the price of coke is generally taken as a basis.

If, for technical or other reasons, small consumers cannot be grouped, the price of heat on the two-part tariff is estimated from the probable quantity of heat required for an average winter. This simple method has the drawback that the conditions during a particular winter may be very different from the average. Thus, if the " degree-days " (external temperature) are 12 per cent. more than in the average winter, the supplier of heat would have to deliver 12 per cent. more heat than estimated, but in order to keep the tariff simple, a system of modification depending on the number of " degree-days " has not yet been introduced.

Hot Water or Steam?

In Europe the general practice is to use hot water for the central heating of buildings, but it is still an open question whether hot water or steam is technically the most suitable medium for long-distance transmission of heat. The most economical solution generally depends on the special requirements of the consumer of heat as well as on how the mains can be laid. When preparing the scheme for the district heating power station of the Federal Technical University it was found that the cantonal hospital, which is near the power station, could be best supplied by means of steam, while the cantonal administrative building was more suitably supplied by hot water.

Apart from the special requirements of the consumers, the choice of one or other system depends particularly on the cost of the constructional work. The mains between the district heating power station and the cantonal hospital could mostly be laid in ground which was fairly open, so that there was nothing to prevent the construction of an accessible duct with a uniform fall. Losses in the mains have been reduced by installing two pipes of different diameters, one or other of which can be put into service according to the seasonal heat required.

On the other hand, as mains leading to the cantonal administrative building had to be laid where many changes in direction both horizontally and vertically could not be avoided, transmission by hot water was evidently the most suitable, since elimination of the draining arrangements necessary for a steam main rendered the cost of installation much more favourable.

A separate pipe is provided for the water flowing from and to the power station, but the usual standby pipe has not been installed. The maximum pressure in the main is about 270 lb. per sq. in. The welds were carried out on the Sulzer system with inserted rings, allowing the weld to be made with certainty right down to the root.

Electricity and Smoke Abatement

THE part that electricity plays in the reduction of smoke was the subject of a paper by Mr. G. S. Francis (E.D.A.), presented at the seventh annual conference of the National Smoke Abatement Society at Bristol (September 19th-21st).

Mr. Francis said that such anti-smoke propaganda as had been conducted in the past had not succeeded in touching the imagination of the public deeply enough. He believed that people were beginning to perceive that electricity was not merely an alternative means of doing old and familiar things, but brought with it a new technique and a fresh outlook. The function of electricity was to enable one to do things that were never done before and to provide unique conditions of life and work which were unthinkable and impossible by non-electric means. By appreciating the nature of electrical energy aright and by using it energetically and intelligently, a civilisation could be produced in which the smoke, dirt, and congestion of the past would fade completely out of the picture.

Four-fifths of factories were using electricity for one purpose or another and more electric power was now being used to drive industrial machinery than all the steam, gas, and oil power used at the beginning of this century added together. The newer factories and the new industries now developing in the south of England were large users of electricity, under the influence of which a new type of industrial district was arising in which industrial activity and healthy domestic conditions were happily wedded together. They were sufficiently decentralised to ensure pure air and a hygienic environment, while electricity made it possible to distribute heat, power, and light over relatively wide areas without penalising industry by high costs.

While electricity could not promise an immediate solution of the smoke problem in the domestic sphere, it was exerting a distinctly beneficial influence. The fact that the provision of a complete electrical service to new houses and flats saved construction costs had often been obscured by doubts as to whether the running costs were within the tenants' means. This question had been made the subject of expert inquiry by many of the public and quasi-public bodies responsible for slum clearance and re-housing activities, with the result that positive and favourable evidence was now available and was being put into effect.

The Weekly Cost

The amount of money that people whose incomes ranged from 40s. to 60s. per week could afford to pay for light and heat was between 3s. 6d. and 5s. 6d. per week, out of which provision must be made for a coal fire in the living room for the winter months. When electricity was used merely for lighting, the costs of generation and distribution were met by charging 6d. or thereabouts a kWh for the small amount of electricity that lighting consumed. But for this general service a different method of payment had been designed. Part of the costs were met by a standing charge, which in such cases was about 6d. per week. To this must be added the charge for the hire of the electrical apparatus installed, usually about 1s. per week, with a small kWh charge of ½d. or ¼d.

In flats for re-housed tenants in St. Pancras, except for one coal fire, all the lighting, cooking, water heating and certain smaller domestic operations such as ironing, &c., were performed by electricity. Each tenant had one coal fire in the living room which could be supplemented by electric heat for occasional use. The average weekly cost to a flat consisting of kitchen, three rooms, and bathroom was :—Hire of cooker, fire, electric iron and washboiler, 1s. 1d.; standing charge and meter rent, 7d.; electricity consumed, 2s. 1d.; total, 3s. 9d. The tenants generally agreed that electricity was reasonable in cost and they liked it.

Numbers of other London boroughs were developing on similar lines, giving a wide range of electrical facilities to their poorest tenants. In the provinces such well-known examples as the Sutton Trust and municipal schemes at Hull and Bradford embodied domestic electrification as a cardinal feature of their re-housing plans, while Preston (Lancs) had already 1,025 such houses electrically equipped.

In groups of country cottages in the county of Dumfries, Scotland, the tenants were supplied on the basis of either a payment of 1s. 9d. per week made up of standing charge, hire charge for cooker and hire purchase charge for the installation, or £1 per room per annum, plus hire rentals, and ½d. per kWh consumed in each case. On this basis the average expenditure on electricity for lighting and cooking was just under 3s. per week, including the hire and standing charges. These results were in close accord with experience in many other rural areas.

The electric cooker and washboiler were capable of supplying most of the heat for cooking, washing, bathing, &c., in small houses. Where these appliances were used the amount of money required for coal might fall as low as 1s. 6d. to 2s. per week, according to the locality, size of family, &c., while the expenditure on electric light and heat, including hire of apparatus, would be on an average 2s. 6d. to 4s. per week. The possibility of developing this type of house was now fairly extensive. In every town in the United Kingdom of more than 100,000 population and in every one of the twenty-eight London boroughs electricity could be obtained for domestic purposes, other than lighting, for ½d. per kWh or less.

Portable Photometers

The revision of the British Standard Specification No. 230 for portable photometers (visual type) that has just been issued was undertaken chiefly at the request of the Street Lighting Committee of the Institution, which required a photometer with a greater degree of accuracy than that provided for in the original issue of the Specification. The limits of error in the indications have therefore been reduced from 15 to 10 per cent. The effective range of the photometer has also been modified and several other small changes have been made in the Specification, including the addition of an appendix with regard to measurements involving large colour differences. Copies of this revised specification may be obtained from the Publications Department, British Standards Institution, 28, Victoria Street, London, S.W.1, price 2s. 2d. post free.

Indirect Measurement of Torque. By F. E. Butcher

IF the load on an induction motor is slowly increased the speed will fall, but it will be constant or stable for any given torque until maximum torque is reached. If this torque is maintained the machine will stop running. In fact, as the speed is in an unstable condition, it will probably be impossible to obtain a complete speed-torque reading by ordinary methods, such as a pony brake. Moreover, long before the necessary time has elapsed for the completion of a series of these readings, the motor will have destroyed itself due to overheating. The speed-torque curve of an ordinary induction motor (fig. 1) shows that the unstable condition is maintained until about two-thirds of full speed.

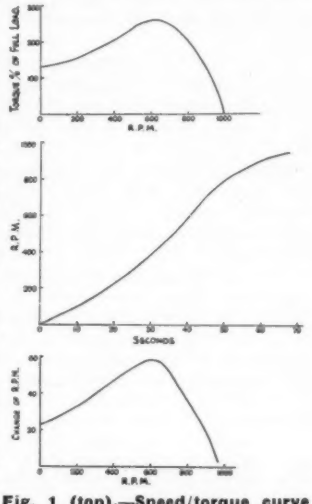


Fig. 1 (top).—Speed/torque curve of a normal induction motor. Fig. 2 (centre). — Time/speed curve. Fig. 3.—R.p.m./change of r.p.m. curve

Deliberately avoiding mathematics the speed-torque characteristic may be determined by first ascertaining the maximum torque developed by the machine (if possible for checking purposes) and the speed at which this occurs. Then fit a heavy flywheel or other high inertia load of negligible friction and apply a steady voltage of about half the full value so that the combination of voltage and inertia gets the machine up to speed in a minute or more. Starting from rest, switch this voltage on to the machine and record the speed every five seconds in the usual way. When the results are plotted they will form a time-speed curve similar to that in fig. 2.

Now the torque at any instant is proportional to the acceleration at that instant and the average torque over a very short period is proportional to the change of r.p.m. during the period. Therefore, if the graph is divided into a number of equal increments along the time base the change of r.p.m. occurring between any consecutive pair of points will be a relative measure of the torque during that particular period.

Proceed as follows to plot a new curve with r.p.m. against change of r.p.m. (fig. 3) and mark off 2½ sec. intervals. During the first interval the average speed will be 12 r.p.m. and the change of r.p.m. 24. Plot this point on the curve. During the second interval the average speed will be 36 r.p.m. and the change of r.p.m. 24. Plot this point on the curve and proceed thus until the curve is finished. The shape of this curve will obviously indicate the shape of the speed-torque curve and (the maximum torque being known) it only remains to plot out the curve on the correct scale. It is apparent that it is useful to have the speed at which maximum torque occurs as a check.

One further useful point is that, as the slope of the speed-time curve towards the end of the accelerating period is very gradual, it may be an unduly long time before the final speed is reached. The value of this final speed can be found indirectly by noting the point at which the speed-torque curve crosses the zero line, which figure will also be an indication of the extent of the windage loss in the flywheel, if this is appreciable.

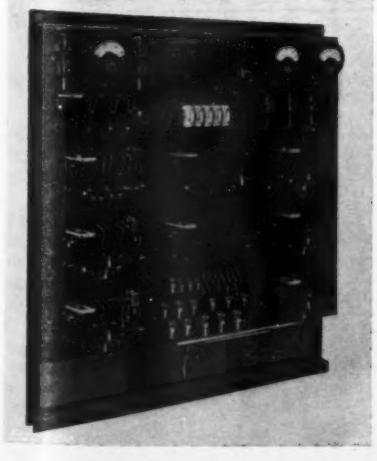
The same method may be adopted in the case of engines and other plant, by suitable modification of detail while retaining the principle.

TABLE FOR OBTAINING FIG. 3 FROM FIG. 2.

Time in secs. ...	0	2½	5	7½	10	12½	15	17½	20	22½	25	27½	30	32½	35	37½	40	42½	45	47½	50	52½	55	57½	60	62½	65	67½	70
R.P.M.	0	24	48	74	100	128	158	190	223	259	297	338	382	429	479	533	590	648	704	752	793	827	857	882	903	920	934	943	
Change of R.P.M.		24	24	26	26	28	30	32	33	36	38	41	44	47	50	54	57	58	56	48	41	34	30	25	21	17	14	9	
Average R.P.M....		12	36	61	87	114	143	174	207	241	278	318	360	406	454	506	562	619	676	728	773	810	842	870	893	912	927	939	

Electric Crane Control

FOR the control of a.c. and d.c. cranes the hoist motor of which does not exceed 50 h.p. the minimum apparatus required consists of one to three standard drum controllers (depending upon the number of motors for driving the crane, *e.g.*, hoist, traverse and travel) and a protective panel of either the hand-operated or contactor pattern to safeguard the motors. In the case of larger cranes it is not possible to standardise the gear as the requirements vary in detail, but it is recommended that contactor control should be employed for both a.c. and d.c. service.



A.c. contactor panel for controlling a 120-h.p. hoist, 20-h.p. slewing and 70-h.p. luffing motors

Small Equipments

Protective panels are manufactured by the General Electric Co., Ltd., in hand-operated form for light-duty cranes for which the capacity of any two motors does not exceed 30 A, and where hoist motors up to 10 h.p. are used. They are similar in construction and comprise a standard iron-clad switch together with a number of fuses, all contained in a sheet-steel case.

Pilot lamps are mounted on top of the panel to indicate when the various circuits are alive, while provision is also made for a portable hand lamp for inspection purposes; this lamp is controlled by a double-pole switch on the side of the steel case, the cover of which is interlocked with the main switch. Compact construction enables a standard panel easily to be mounted in the crane control cabin.

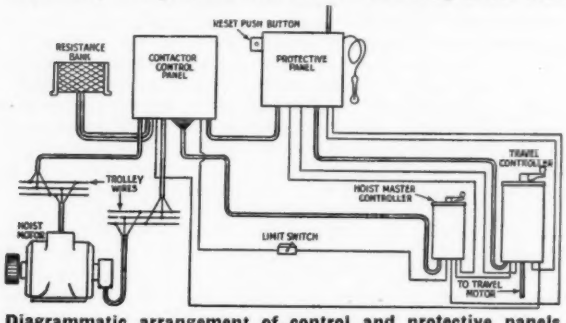
Contactor protective panels are recommended in all cases where the hoist motors are from 10 to 50 h.p., and they can also be used with advantage for smaller cranes when it is of primary importance to avoid delay in replacing "blown" fuses, but the capacity of any two motors must not exceed 300 A. A three-motor a.c. equipment comprises a triple-pole contactor, two overload time-lag relays in each motor circuit and one instantaneous overload relay in the common return. A portable inspection lamp controlled by a double-pole switch, pilot lamps, a push-button for resetting the main contactor after it has tripped due to overload and a main iron-clad isolating switch are also provided. Equipments for d.c. service are similar, except that a double-pole contactor with magnetic blow-outs is used in place of the triple-pole contactor, while each motor circuit is protected by a time-lag overload relay in one pole, a further instantaneous overload relay being provided in the common return.

The gear is mounted on an insulating panel in a sheet-steel case for a maximum of from 75 to 300 A for any two motors. In addition to saving the time needed to replace blown fuses contactors provide protection against low voltage and electrical interlocks can be arranged.

Large Controllers

For machines larger than 50 h.p. contactor panels have the advantage that the maximum acceleration of the motor is fixed either by the current or by the time interval (either being adjustable to suit a wide range of service), while at any acceleration lower than the maximum the operator has full control. The master controller is small, generally of important-ance in a confined crane cab, and can be worked continuously without the fatigue that would be caused by a heavy drum controller.

A standard reversing panel for a.c. consists of two line reversing contactors (mechanically interlocked to prevent their being closed at the same time) and a number of accelerating contactors, each provided with a current limiting device with



Diagrammatic arrangement of control and protective panels for a hoisting motor

which it is mechanically connected. For d.c. two pairs of mechanically interlocked line reversing contactors are required. The starting resistances may be assembled behind the contactor panel or mounted independently.

If desired, two controllers can be coupled mechanically through special operating gear which is so arranged that horizontal movements of the handle cause left and right traverse of the load, while raising and lowering of the handle raises and lowers the load; the two motors are then governed by one handle. Contactors may also be arranged to operate such auxiliaries as grab motors and lifting magnets, and they are suitable for use with shunt solenoid brakes.

Dynamic Braking

Dynamic (or potentiometer) braking, for d.c. only, has many advantages over mechanical braking. It is generally given by a series motor the field of which is connected in series with a resistance across the line, its armature being tapped across a portion of the resistance. If the load be sufficient the motor will exert a steady braking torque and limit the lowering speed, or power will be automatically applied to lower a light load, the speed being determined by varying the resistance.

When hoisting, the motor is generally used as a plain series machine. When, however, it is desired to arrest the longitudinal travel the motor armature can be disconnected from the line while the field is separately excited; the power generated is then dissipated in resistances connected across the armature which, therefore, comes rapidly to rest.

Diversity Factor. By F. S. Naylor, A.C.G.I., A.M.I.E.E.

Its effect on low-voltage supplies

THE relative importance of diversity as an item in the cost of giving supplies to low-voltage consumers can be shown graphically in a simple form. Diversity being the ratio of the sum of the consumers' kW demands to their total effective demand, the diversity factor $m=w_1+w_2+w_3+\ldots./w_s$, where w_1, w_2, &c., are the individual low-voltage consumers' kW demands and w_s their effective demand on the bulk supply. Twisting the equation round, $w_s=w_1+w_2+w_3 \ldots .$ (1)$/m$. If the annual load factors of the above demands are f_s, f_1, f_2, f_3, &c., then the total consumption of electricity per annum of a given group of low-voltage consumers under consideration will amount to

$$w_s \times f_s \times 8{,}760 = w_1 \times f_1 \times 8{,}760 + w_2 \times f_2 \times 8{,}760 + \ldots .$$

The load factors in the above are expressed as a decimal less than one, *e.g.*, an 80 per cent. load factor must be taken as 0.8. Substituting (1) we get

$$\left(\frac{w_1+w_2+\ldots.}{m}\right) f_s = w_1 \times f_1 + w_2 \times f_2 + \ldots . \quad (2).$$

Now, if we consider groups of consumers, the consumers in each of which have the same load factors and demands, that is to say, $f_1=f_2=f_3$, &c., and $w_1=w_2=w_3$, &c., equation (2) becomes $f_s/m=f_1$. At the upper limit, with a system load factor of 100 per cent., the diversity necessary among groups of consumers having load factors from 0 to 100 per cent. is given by curve "A," fig. 1, the lower limit with no diversity being 1.0.

Messrs. Woodward & Carne, in their I.E.E. paper, when analysing the costs of electricity supply to various types of consumers, considered the question of diversity carefully amongst various groups of consumers, and found that generally curve "B" relates to high- and low-voltage connections the relationship was as given by curve "B," fig. 1. While generally, an approximation to it, as given by curve "C," fits in fairly well with data relating to low-voltage consumers only, which I have collected from time to time. The accuracy of such a relationship as given by curve "C" can be questioned, particularly at load factors of the order of 5 per cent., but it is mainly proposed in the present instance to illustrate in the following graphical method the effect of diversity on the cost of giving supply. Curve "C," which follows the equation $mf^{\frac{1}{3}}=1$, is sufficiently near curve "B" for all practical purposes, and has been used in the following graphical method.

The above principles can now be applied to the figures normally considered in tariff formation. The case of a partly developed semi-rural area can be taken as an example. After taking into account cost of transmission lines, sub-stations, mains, switchgear services, meters and losses, the cost of electricity delivered to low-voltage services might reach the fairly high figure of £12 per kW of low-voltage maximum demand+0.35d. per kWh with no diversity, or an overall rate of 0.329d./f+0.35d. per kWh (3). With diversity m, the cost of electricity at the low-voltage services would amount to £12/m per kW of maximum demand+0.35d. per kWh, or $12\times240/m\times8{,}760\times f$+0.35d. per kWh. Substituting $m=1.0/f^{\frac{1}{3}}$, the cost of electricity works out at $0.329/f^{\frac{2}{3}}$+0.35d. per kWh (4).

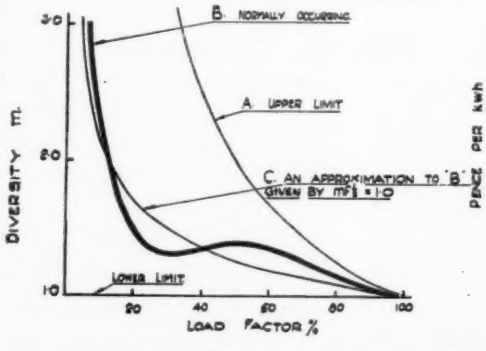


Fig. 1.—Diversity among groups of consumers having the same load factor.

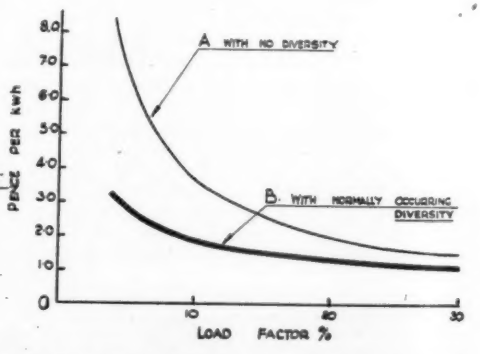


Fig. 2.—Cost per kWh of giving a supply to l.v. consumers

Fig. 2 gives the cost to an undertaking per kW of supplying electricity to low-voltage services; with no diversity, curve "A" (from equation 3) applies, and with normally occurring diversity curve "B" (from equation 4).

Curve "A" is roughly half the height of curve "B," and therefore these curves show graphically that, by reason of the diversity suggested as normally occurring between consumers, the cost to an undertaking of giving supply may be something like half of what it would be if there were no diversity.

Furthermore, it illustrates that at the present time among classes of consumers where load factors are below, say, 20 per cent., diversity factor is of equal importance to load factor as a governing item in fixing equitable charges for electricity. It finally leads to consideration of the outstanding difficulty in framing tariffs for some of the potential loads, because of the lack of information as to their diversity. In particular, the author has in mind building and water-heating loads of the thermostatically controlled type. There undoubtedly remains a great deal to be done in ascertaining the characteristics of such loads on a proper statistical basis, so that appropriate (and, in all probability, exceptionally low) tariffs can be quoted.

Correspondence

Correspondents should forward their communications as early as possible. No letter can be published unless we have the writer's name and address in our possession

Safety with A.C.

Referring to the "Leader" in your issue of September 20th I have not read Mr. B. C. Chatterjee's article in *Science and Culture*, but if he refers to 230 V a.c. for domestic purposes in India, then I am fully in agreement with his views. It must be remembered that all houses in India (on the plains) have stone floors, *i.e.*, cement in the poorer types of houses and polished stone in the better types of houses.

In the Bombay district and also in Bengal the average humidity during the year is well over 70 per cent., and in the monsoon it is for weeks over 90 per cent. Up-country the humidity is quite low for nine months, but approaches 90 per cent. during the monsoon. When one takes into consideration the fact that Indians practically never wear shoes in their homes it will be seen that the danger of fatal accidents is very real.

The danger is, of course, minimised by bakelite switches and the like, but the fact remains that the greater part of the wiring work in India is deplorably bad and the fittings and switches are of the cheapest Japanese and Continental manufacture. This applies to the average houses in the Bazaar and not, of course, to houses owned by large manufacturing companies and railways where the standard of wiring is very good indeed.

I would suggest that 230/110 V transformers should be installed at the service point of each house. The transformers should be double wound and the mid point of the 110 V winding earthed. This would eliminate any danger of fatal accidents, although the cost would be very high.

During a recent visit to Canada and the United States I was impressed by the good voltage regulation on the l.v. mains, which are almost invariably worked at 115 V. This was apparently obtained by a very large number of pole-mounted transformers which were installed at almost every street corner. The distribution mains are nearly always overhead, and while this permits the use of a multiplicity of transformers yet the general untidiness constitutes a veritable eyesore which would not be tolerated in England.

In conclusion, I submit that while a.c. distribution at 400/230 V is reasonably safe in England with a highly civilised population, its employment in a tropical country is fraught with considerable risk of fatal accidents. H. W. P.

September 29th.

Amateur Wiring

Is it not time that something was done to prevent amateurs and unauthorised persons from wiring and making electrical connections to apparatus?

At an inquest held locally to-day on a young boy who died as a result of receiving a shock from a metal hair-dryer it was found that the three-core flex had been connected wrongly to the plug head, the earth wire being connected to a live pin.

In the words of the Coroner, "The trouble here has been caused by an amateur fitting up the plug, and it ought not to be allowed. It is an extraordinary thing," he continued, "that these electrical appliances can be attached by persons with little or no knowledge, and that there are no regulations so far as I can see which render it an offence to do so."

Some of the work being carried out to-day by so-called contractors more resembles the web of a gigantic spider than an electrical installation. The licensing of all journeymen electricians and compulsory membership of the National Register of all bona-fide electrical contractors is indicated, at the same time giving the supply authorities powers to refuse connection to an installation which they deem unsatisfactory in any way.

You have found space in your valuable journal for many letters of this description lately, and I sincerely hope that they will continue until some authority or other takes the matter in hand. Surely between the accumulation of electrical engineers composing the I.E.E., the A.S.E.E., the E.P.E.A., the N.R.E.I.C. and the E.C.A. something can be evolved to improve the existing atrocious state of affairs.

Accrington, *September 18th.* JOHN F. BRIDGE.

A Librarian's Request

I am anxious to build up a collection of the latest trade pamphlets, catalogues, &c., for my reference department, in the subjects covered by your publication. I should be grateful if firms would send such material and add my name to their regular mailing lists.

I feel that co-operation of this kind will prove extremely useful to local firms and their personnel and will be mutually advantageous. W. A. MUNFORD.

Dover, *September 18th.* *Borough Librarian.*

Ships' Electrical Installations

I was interested to read the précis of Mr. H. G. Leivesley's paper. I have not yet had the opportunity of reading the full text of the paper, which I understand is very complete, but there are one or two points in your précis which call for some explanation.

In talking of oil engines, it is stated that difficulties associated with high piston speeds and torsional oscillation have been encountered. While it is true that such difficulties occurred in the early stages, it is equally true to state that these difficulties have been entirely overcome in modern Diesel engine design. The article then refers to small sets of 300 kW running at 900 r.p.m., and, although speeds of Diesel engines are admittedly increasing, this would be too big a jump for present day marine practice.

The statement that "with the adoption of electric cooking, baking, and luxury hotel services the average sea load on the auxiliary generating plant is 1.25 kW per person on board" is rather a sweeping one. The average sea load on board ship depends on so many variables that it may be anything from 0.25 kW to over 1.5 kW per person on board, the first figure being for a steamship with steam-driven auxiliaries, and the latter for a Diesel engine vessel with electrically driven auxiliaries and blowers.

Under the heading "Steering Gear" it is stated that there is a definite preference for continuously running motors. This statement by itself might lead some people to suppose that the electro-hydraulic system was more in favour than the all-electric, and there is no doubt that in the early days this was the case. This is easily understood, as the training which the marine engineers had in those days helped them to understand the workings of a pump very much more easily than

Members of the Iron and Steel Institute at the Metropolitan-Vickers Works, Trafford Park **(see page 413)**

the control of the all-electric gear. The advent of motor ships, however, has entirely overcome the old prejudices against electrically driven machinery. Possibly, however, the author is comparing the motor-generator type of all-electric steering gear with the contactor type, which may now almost be considered obsolete.

After stating that the size and weight of the control gear need to be reduced, the author advocates the more general introduction of sheet-steel cubicles of the dead front type, which would, of course, take up very much more room than the more usual type of switchgear. Then, again, it is difficult to understand the statement that "the auxiliary plant installed in an electrically propelled ship is of roughly twice the aggregate power of that fitted in a cargo liner." Does the writer mean that an electrically propelled cargo liner would require double the auxiliary output of, say, a motor propelled cargo liner of the same tonnage? If so, the statement cannot be correct.

If the electrically propelled ship was of the Diesel-electric type, then apart from the excitation of the main generators and motors the auxiliary plant would be the same as would be required for the motor ship. The same would apply if the electrically propelled ship were of the turbo-alternator type and the other a direct turbo drive. It is possible that by "cargo liner" the author of the article refers to a steamship with steam-driven auxiliaries, although this is rather discounted by the next sentence, which states that "whereas a steamer of 8,000 tons may require electrical plant of 50 kW only, a motor ship of similar size with electrical auxiliaries may need 700 kW." FRANK JOHNSTON.

Queen's Island, Belfast, *September 20th.*

To Lag or Not to Lag

The article by Mr. Russell Hickmott in the September 20th issue of the ELECTRICAL REVIEW states that many consumers do not wish to have their cylinders and tanks lagged. Surely it is for the electricity suppliers to educate clients to the importance of lagging. Three inches of cork is not necessary for the purpose; there is a jacket on the market only 1½ in. thick giving about the same efficiency.

"To lag or not to lag" is merely a matter of common sense. I would suggest two small experiments between the two parties. On any night of the week a non-lagger to stand (or sit) in his garden naked, with a lagger alongside lagged with 1½ in. of fleecy wool; umpires with recording instruments to take periodical readings of temperature differences and to observe which party cools sooner and, after, say, two hours calculate how much fuel (liquid or otherwise!) is required to bring each back to normal temperature. For the second experiment repeat the same process exactly but in mid-winter with an east wind blowing.

Unless the non-lagger is a nudist case-hardened by years of experience he will be converted, even to the extent of forgetting all about hand or thermostatic control. Minor experiments of a similar nature may be carried out by anyone in the privacy of their own bathrooms. ANTI-NUDIST.

September 21st.

A Neutral Relay

Mr. Bullen, in his interesting article in your last issue, is in error in stating that an earth-leakage switch requires energy to the extent of 2 VA for operation. He instances 200 mA at 10 V, and 30 mA at 66 V, and proceeds to criticise the device from this angle.

Actually, an efficient earth-leakage switch will operate with 25 mA with 500 ohms earth resistance in series at 25 V, which is considerably less than 1 VA. It would be more accurate to say that the average energy required does not exceed 0.5 VA, from which he will see that the operating potential is not nearly as high as he has visualised in his article.

Further, an earth-leakage switch does not transgress the Commissioners' Regulations, which Mr. Bullen's device appears to ignore. T. C. GILBERT.

Folkestone, *September 21st.*

Discounts Again!

It is to be regretted that the practices of the wholesale trade still permit apparatus to be purchased direct when the electrical contractor has done all the dirty work and is usually responsible for the very apparatus for twelve months at least after it is fitted. He is invariably called to remedy some fault caused by this apparatus although he has taken no part in recommending it, nor has he ever participated in the "*trade*" discount which architect, owner, builder or anyone appear to obtain to the exclusion of the electrical contractor.

In a recent case a builders' merchant supplied some fires and refused to recognise us at all, but we were recognised by the firm supplying the cookers, in a small way. It is surely time that discount-snatching by builders' merchants, especially as in this case where they simply passed the order to the manufacturer, ought to be stopped. The electrical manufacturers and wholesalers might take a leaf out of the book of the motor trade. WATSON, MARSH & CO., BRONDESBURY, LTD.

London, N.W.6, *September 20th.* M. WATSON,
Managing Director.

Costs and Tariffs

IN a paper on this subject by Mr. F. J. Elliott, chief engineering assistant, Wolverhampton Corporation Electricity Department, which was read at Birmingham (before the Midland Technical Group of the Electrical Power Engineers' Association) the opinion is expressed that results very much nearer the truth can be obtained by a careful study of the actual costs of the various undertakings than will ever accrue from analysing theoretical and assumed average conditions.

The purpose of the paper is, therefore, two-fold. An attempt is made to arrive at a reasonable and average cost by analysing the returns of a large number of undertakings; and an endeavour is then made to ascertain whether the factors generally used in building tariffs, such as type of load, load factor, and diversity factor, have the controlling influence on costs attributed to them.

In 1932 645 authorised undertakings sold 9,501,000,000 kWh. Undertakings selling ten or more million kWh per annum (about 150) served populations varying from one million to 37,000 and sold from ten to 500 million kWh per annum.

Although these undertakings formed only 23 per cent. of those authorised, at the same time they supplied 64 per cent. of the total consumers and 78 per cent. of the total kWh sold. Taking these facts into consideration, it was reasonable to conclude that an analysis of the costs and tariffs of these selected undertakings would give some indication of the average conditions obtaining in the industry.

The conclusions drawn by the author from his analysis were briefly summarised as follows:—The costs from station busbars all the way through to consumers' terminals varied so widely that it was impossible to select any figure in respect of any particular cost and use it as a basis of comparison. The preponderance of a particular type of load was not reflected in the system load factor, owing to the diversity of the demands made by the individual consumers. Load factor did not exert the controlling influence on total costs with which it was credited. Output per consumer had a greater influence than other factors, after the cost of energy had been met.

If these conclusions were correct, then it naturally followed that tariffs based on the ideas prevalent to-day must be uneconomic and unjust.

Standardisation of tariffs could only follow standardisation of costs. The operation of the Central Electricity Board would result in some measure of uniformity in the matter of energy charges, but these formed only some 40 per cent. of the total cost. There was a wide scope for bringing about big reductions in the remaining costs. Standardisation of some of the apparatus used would result in considerable saving in capital cost.

Diverse local conditions were the chief obstacle to securing more uniform costs of distribution, but considerable results would accrue from the re-apportionment of supply areas in such a manner as to secure a more equitable division of the different types of load and areas, *e.g.*, industrial, domestic, town, rural, to each distribution authority. The Central Board had adopted the principle of pooling the costs of transmission, and there appeared to be no reason against the adoption of the same principle by supply undertakings.

With regard to simplification of tariffs, the large industrial user could quite well take care of himself, as, generally, he was in a position to demand a competitive price and, moreover, standard tariffs were not desirable or possible with this type of user. In the case of other users it was suggested that tariffs must conform to the universally recognised principle of reduction in cost per article with increase in the number purchased.

Long-hour use could be encouraged by charging a very low rate for all supplies taken outside the normal load hours of the undertaking irrespective of the purpose for which the energy was used.

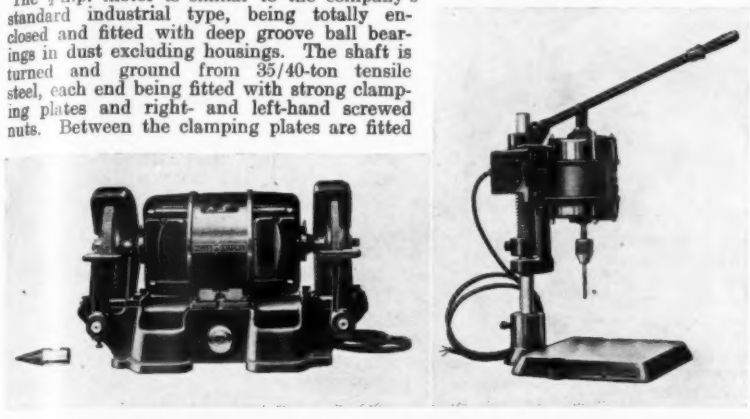
The adoption of the principles outlined would result in a simple two-rate tariff and the hours during which the low rate became operative could be varied according to local conditions and could again be varied as those local conditions altered due to the growth of any particular type of load.

New Apparatus and Devices

for Domestic, Cooking and Heating, Lighting, Power and Scientific Purposes

Bench Grinders and Drilling Machines

A new range of small electric tools is announced by HIGGS MOTORS, LTD., Witton, Birmingham, 6. At present it consists of a self-contained bench grinder and a self-contained light drilling machine. The bench machine has been designed as a compact general purpose tool grinder of robust construction. The ½-h.p. motor is similar to the company's standard industrial type, being totally enclosed and fitted with deep groove ball bearings in dust excluding housings. The shaft is turned and ground from 35/40-ton tensile steel, each end being fitted with strong clamping plates and right- and left-hand screwed nuts. Between the clamping plates are fitted two "general purpose" grinding wheels each 7 in. in diameter; one is ½ in. wide of fine grit and the other ¼ in. wide of coarse grit.



The Higgs bench grinder and (right) drilling machine

The shaft is arranged so that a removable (taper-screwed) false nose to take polishing mops can be fitted at one end without removing the grinding wheel. The motor is mounted on a cast-iron base carrying the wheel guards, which are in accordance with H.O. Specification No. 7, and the adjustable tool or work rests. The base is also designed to incorporate two water-pots in the casting and a protective housing for the operating switch.

The light, yet strong, bench drilling machine incorporates a motor rated at ¼ h.p. at 1,425 r.p.m. mounted vertically on a stand with a machined cast-iron base. The height of the chuck above the base is capable of considerable adjustment and allows for a vertical movement controlled by the operating lever of approximately 3 in. The chuck will take drills up to ½ in. in diameter, its movement being controlled by a long operating lever against a substantial coil spring. The unit is capable of taking work up to 8 in. diameter circles and the height of the chuck from the base can be easily adjusted up to a maximum of 8 in.

A Flame-proof Lighting Fitting

The self-contained cable-end coupling and lantern introduced by MESSRS. GEORGE ELLISON, LTD., Perry Barr, Birmingham, 20, has passed the tests of the Mines Department at Buxton for roadway lighting in collieries.

The couplings will take two- or three-core single-wire-armoured cables up to 7/.044 and a maximum diameter under armour of 11/16 in., and will carry 15 A at 230 V, though the Coal Mines Regulations limit the duty to 10 A at 125 V.

The Ellison flame-proof fitting

The ends of cables may be connected and sealed before being taken to site, and four cables may be connected without disturbing the straight-through connection. The links may be removed for isolating a cable. Two lanterns may be bolted to a straight-through connection and the terminal covers will fit any of the eight possible arrangements of couplings or lanterns.

An Elastic Stop Nut

A stop nut for the connections of terminals, instruments, switches, transformers, overhead line equipment and catenary fittings has been introduced into this country by MESSRS. SIMMONDS AEROCESSORIES, LTD., Shell-Mex House, Strand, W.C.2.

In design this nut is of standard type, but with its height increased to incorporate an initially unthreaded fibre collar with an internal diameter slightly less than that of the bolt. The bolt cuts its own thread in the collar, the fibre wedging itself into the bolt threads. It is claimed that the constant upward force permits a permanent flow of current through the connection, the provision for temperature changes being automatic.

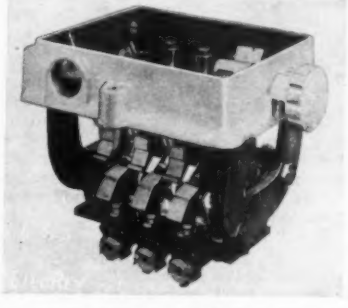
Colour Filters

Difficulty has often been experienced with stage and auditorium colour lighting installations, because many authorities will only allow colour filters made of non-inflammable material to be used. In such cases gelatine or glass filters have had to be employed, and this has affected the efficiency of the installation, for gelatine is not very durable and it is difficult to obtain the correct colours in glass.

A non-inflammable material for use as colour filters has now been produced by HOLOPHANE, LTD., Elverton Street, London, S.W.1. The new material is known as "Holnoblase" and its use is being standardised with all Holophane colour-lighting equipment. It can, however, be obtained separately in sheets. The company claims that this material is durable, mechanically strong and impervious to moisture. It has a density sufficient to enable colour hues of almost spectral purity to be provided, and this characteristic greatly assists the results obtained from three-colour installations.

"Straight-on" Starters

A range of oil-immersed starters (Type A254) suitable for use with a.c. motors up to 2½ h.p. at 110 V, up to 5 h.p. at 220 V, and up to 10 h.p. at 440 V, is being put on the market by M. & C. SWITCHGEAR, LTD., Kirkintilloch, Glasgow.

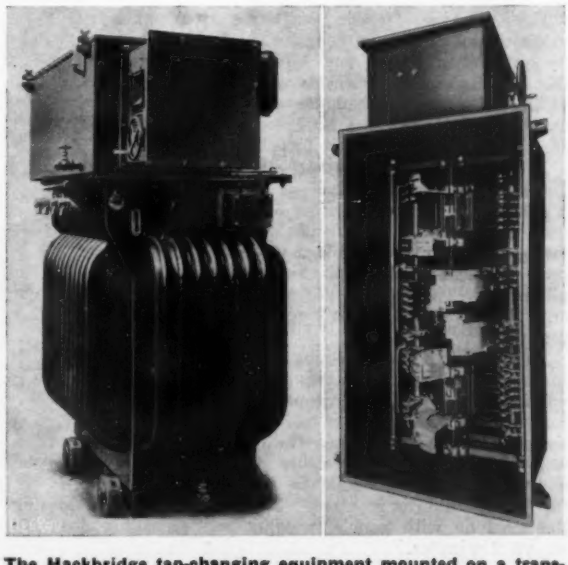


A view of the straight-on starter with cover removed

The action is both quick-make and quick-break, and the renewable copper contacts have a rolling action. The moving contact arms are of channel-section pressed brass, enclosing steel pressure springs which control the copper contact tips, and are secured to an insulated cross bar. Renewable fuses are incorporated. The overall dimensions are 7¼ in. by 7 in. by 6 in.

On-load Tap Changing

The new on-load tap-changing equipment (Type R.D.O.) of the HACKBRIDGE ELECTRIC CONSTRUCTION CO., LTD., Walton-on-Thames, Surrey, while not giving as gradual a voltage variation between tappings as that provided by the larger



The Hackbridge tap-changing equipment mounted on a transformer and an internal view of the apparatus

T.R.D.O. type, is designed to work with negligible disturbance to the system, as the use of a resistance instead of a choke for current limitation obviates inductive kicks during changes. The mechanism, which can be fitted on site to existing transformers in many cases, is housed in two compartments—a welded steel tank integral with the transformer lid, containing the drum-type tap-changing switches, and a smaller compartment on the side of this tank in which are the driving mechanism, tapping indicator and other auxiliaries.

The "Bredon" and "Paralux" fires

There is one pair of cast-aluminium drums to each phase between which is connected a resistance, and the six drums required for a three-phase unit are arranged in tandem along a square insulated shaft. The stationary contact fingers are connected to the transformer windings through oil-tight insulating bushings. The drum shaft projects through an oil-tight gland into the compartment containing the driving mechanism. A spring mechanism prevents partial completion of tap change, and a mechanical interlock blocks simultaneous operation by hand and motor drive. A counter shows the number of tap changes made and remote indication can be provided.

The weight of the motor-operated unit complete is 6 cwt. exclusive of the 60 gal. of oil required. This type can be applied to transformers up to 1,500 kVA, with a maximum current per phase of 50 A, where low cost is important.

The Premier Fire Programme

There are some impressive examples among the new range of "Premier" electric fires which we saw at the London showrooms of PREMIER ELECTRIC HEATERS, LTD., Keeley Street, Birmingham, last week. Two models, in particular, stand out as fine examples of the modern style of electric fire—the "Bredon" and the "Paralux."

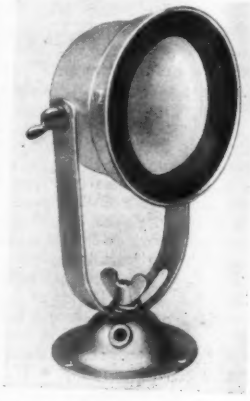
The "Bredon," although straightforward in design, has, by virtue of its shape, a bold and striking appearance, particularly in the florentine ivory and black finish, although florentine ivory and green is also specified. This florentine finish in a combination of colours is also listed for the "Paralux" and is a new "Premier" development which should appeal to the public. In the case of the "Bredon" each rod element, which is of a new pattern, has its own individual parabolic reflector, and a switch is incorporated giving an optional loading of 1 or 2 kW. The "Paralux" may be described as a "reflector fire de-luxe" since no effort has been spared to make it a high-class and robust appliance. The high loading is obtained by three ¾-kW rod elements controlled by two switches at the back of the fire. Again a florentine finish and a chromium reflector are employed.

For those who require a cheaper reflector fire there is the 1-kW "Parabeam," which, like the "Paralux," has an adjustable reflector which can be locked in the horizontal position, a stout guard being provided so that small utensils can be placed on the fire. A still cheaper model (750 W, 5 lb.) is the "Paraglow." Sprayed oxidised silver finish is employed and adjustment for angle is achieved by a movable rear support.

The new range is completed with the "Trent" and "Knowle," two low-priced models employing the standard "Double-Radius" firebar, and the "Maxwell," a less expensive form of the "Bredon." Castings are used for all models, and we were informed that three-core flex is being supplied with all "Premier" appliances. The two imitation-coal fires, the "Gresham" and "Grafton," with their unusually effective flame effect, are being continued in an improved form.

A Scintillating Spotlight

A new form of spotlight is being produced by Mr. C. W. Denny to throw a small scintillating beam of light on to an object in, say, a shop window or other display position; illuminated in this way, articles of glass, jewellery, and electroplate are brought prominently to notice.



A scintillating spotlight

The spotlight is a small projector of about 3 in. diameter using a 4 W low-voltage lamp, focused in a parabolic reflector. The beam of light is sufficiently powerful to permit of the illumination of articles displayed with the projector hidden some distance away, and the illuminating effect is clearly noticeable in bright daylight, while the ordinary shop-window illumination need not be interfered with in any way.

The scintillating device has already been mentioned in our columns, and for use with this projector it is fitted with a small resistance to reduce the voltage and permit of the use of small lighting bulbs, whilst for a.c. supplies a transformer can be used in place of the resistance. ALLIANCE WHOLESALE, LTD., 62, Gt. Russell Street, London, W.C.1, are the wholesale selling agents.

A Large Automatic Welder

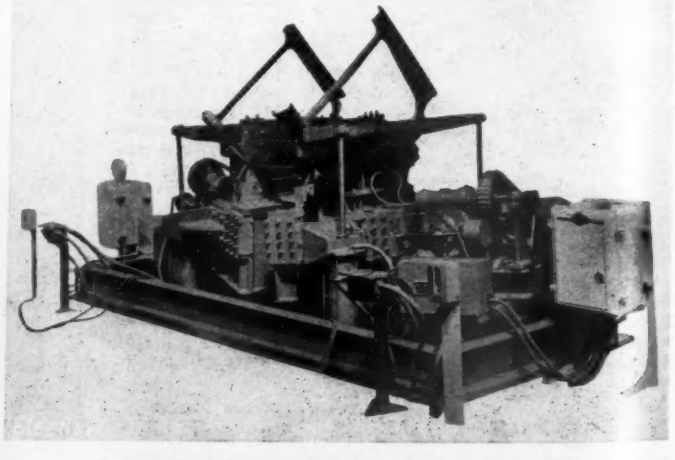
THE first automatic flash welding machine for motor-car body assembly to be built in Great Britain is, we believe, that made by the A-I Electric Welding Appliances Co. for the Pressed Steel Co., Ltd.

The machine, which comprises two units mounted on a common bedplate, each fitted with its own transformers, and arranged to maintain the "flash" over the entire width of the seam, weighs 15 tons and assembles the two side panels and front panels. The total welding time is 8 seconds, and the output is forty bodies per hour.

The clamps are pneumatically operated and governed by control pillars at the front of the welder. The clamping on the moving head in each unit of the front-end machine, with an oscillating movement of 90 deg. passes through the door openings and holds the side panels in definite alignment. The cams of the upsetting mechanism are driven through infinitely variable speed gearing.

The setting of the "flashing" and "upsetting" mechanism in action causes the side panels to approach the front or rear panels at a predetermined speed, and the arc is maintained for approximately eight seconds, when the current is cut off and the "upsetting" pressure applied automatically. Once the machine is set in motion no further attention is required. The inclusive time for loading the machine with panels, welding and unloading does not exceed 2 minutes.

The forged welds are said to have a strength equal to that of the parent metal. The "upset fin" on the outside of the body is rapidly made invisible by disc grinders; the "upset" on the inside being allowed to remain. The direction of a weld can be varied to suit the type of body treated.



An automatic flash welder for automobile body panels

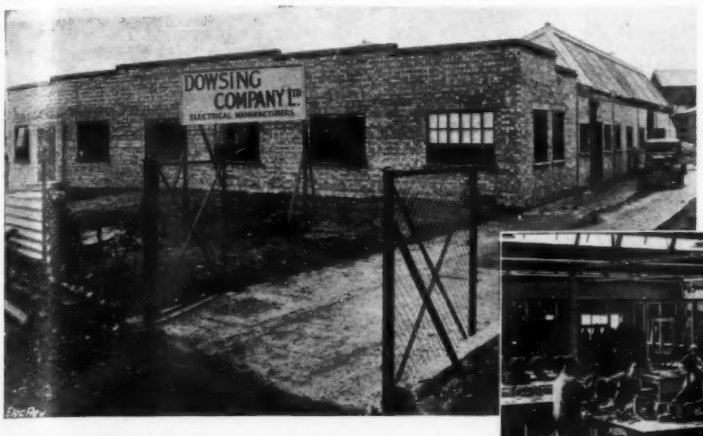
A further order has been received for a complete front-end and rear-end installation (the latter capable of flash-welding seams up to 84 in. in length) for another monopiece all-steel body produced by the Pressed Steel Co., Ltd.

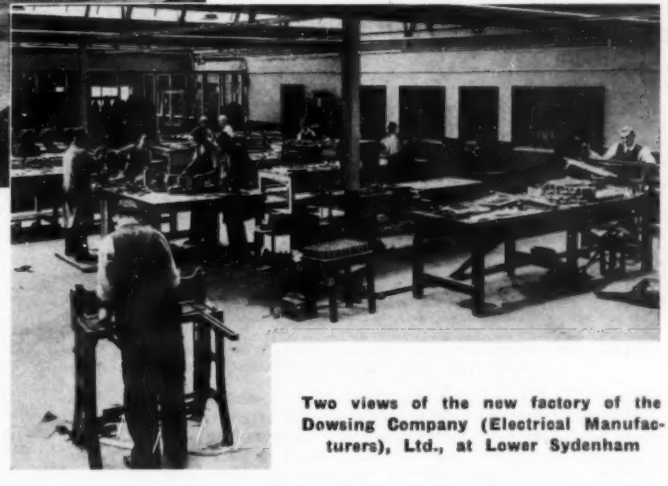
A New Sydenham Factory

A pioneer company re-enters the domestic appliance market

ALTHOUGH in recent years the activities of the Dowsing Radiant Heat Co., Ltd., have been concentrated mainly on specialised products such as electric soldering irons, metal and glue pots, branding irons, sealing-wax heaters, and medical radiant heat appliances, when the company was first formed in 1898 Mr. H. J. Dowsing, the founder, held some of the first patents for electric fires as well as other domestic appliances.

Recently a new company called the Dowsing Company (Electrical Manufacturers), Ltd., was formed to take over the whole of the manufacturing side of the business, and with the completion last month of an entirely new and up-to-date factory at Kangley Bridge Road, Lower Sydenham, London, S.E.26, it is the intention to develop the domestic market by the manufacture of a number of modern and attractive appliances at competitive prices.





Two views of the new factory of the Dowsing Company (Electrical Manufacturers), Ltd., at Lower Sydenham

A new moderately priced reflector type 1-kW fire introduced a short time ago as a kind of vanguard to the attack on the domestic market has proved so popular that the company has experienced a good deal of difficulty in executing orders. With the improved facilities at the new factory, which will be capable of an output four times that of the old works at Acton, delivery troubles should be eliminated. This fire is of a simple design and finish which will blend with any style of furnishing. The tubular frame and adjustable reflector are chromium-plated, the sides being of florentine bronze finish.

Two other types of fire which are to be placed on the market immediately are the "Utility Hot Bar" 1- and 2-kW models. A feature of these is that the metal surround of the elements is curved at the bottom in order to throw the heat well out into the room. The elements themselves are slightly convex and are fitted horizontally with protective bars in front. The 1-kW model measures 11 in. by 14 in. by 6¼ in. and weighs 5¼ lb., and the 2-kW fire measures 17 in. by 14½ in. by 10 in. and weighs 9¼ lb.; both are available in oxidised silver and chromium-plated finishes. They are of pleasing appearance and sturdily constructed. Handles, invisible from the front, render them easily portable.

In the drawing office at the factory we noticed during a recent visit a rough model of a 600-W fire rather similar to the larger reflector type model mentioned above. This will probably be one of the next items placed on the market.

Although the company proposes to direct its attention particularly to fires, at any rate at present, it already produces a number of other domestic appliances which are being improved and brought up to date.

A toaster, which is being retailed at a low price, is designed hygienically to prevent the accumulation of crumbs and has a unique attachment for storing flex when not in use. It is nickel finished and has heat-resisting feet. The company is also the maker of the "Hot-point" electric iron, the cordless model of which is well known throughout the millinery, dress-making and laundry trades.

The factory itself is light and airy and consists of a large central workshop with smaller rooms adjoining for the spraying, polishing, buffing and testing processes and also for storage purposes. There is also a special department for the manufacture of electrically-heated clothing supplied to the Air Ministry. Leading from one side of the main workshop are the administrative and general offices, a drawing office, and a small showroom.

Provision has been made by the company for the extension of the factory when the occasion arises.

New Books

Edison: His Life, His Work, His Genius. By W. A. SIMONDS. Pp. 364; illus. London: George Allen & Unwin, Ltd. Price 10s. 6d. net.

It is safe to say that there was never a life so full as that of Thomas Alva Edison. From his boyhood until his death in 1931, at the great age of eighty-four, "he scorned delights and lived laborious days." His energy was superhuman, and he was the living embodiment of that infinite capacity for taking pains which is genius.

In Mr. Simonds, who was intimately acquainted with him, Edison has found a worthy biographer, who tells the fascinating story of his life in a very readable way. His hero-worship is excusable; his subject stands out so far beyond the ordinary run of human beings. There are passages, however, in which the author claims too much for his hero—entirely unnecessary blemishes.

There were few departments of human activity which Edison entirely neglected, but he was not responsible for *all* the progress made during his lifetime.

These lapses apart, the book is well worth reading, and, although it is not primarily a boy's book, it is one which would form a most acceptable present for any ambitious lad with an inclination towards invention.

Home Mechanic Encyclopædia. By F. J. CAMM. Pp. 392; figs. 627. London: George Newnes, Ltd. Price 3s. 6d. net.

This volume is another publication in a series prepared by Mr. Camm, the previous volumes having dealt with wireless construction and practical motoring. The present volume has been well prepared and is a good guide and companion for scientific recreations.

The information contained in the work has been conveiently arranged and is easily accessible, practical applications being kept well in the foreground. A useful feature of the volume is the précis of the contents of each section which appears in the list of subject headings. The text is rich in interesting detail and profusely illustrated. It will suffice to show the range of interest of the book by stating that it includes sections on aircraft, television, astronomy, cinematography and chemistry.

It is difficult to test and verify the accuracy of the whole of the text, but where particular items have been selected the volume has proved to be useful for the purpose in view. The subjects are dealt with from the popular standpoint, and the student must refer to more erudite publications for more highly scientific information.

The section of cinematography well describes and illustrates modern types of projectors, cameras, etc. For the amateur, the chapter devoted to soldering and brazing should prove of interest as it deals with hard and soft soldering, paste fluxes and the methods which are adopted in the soldering of aluminium.

The encyclopædia should prove of value as a ready reference book for the amateur worker although, of course, it can hardly be used as a manual.

Business and Industrial Notes

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations, and Failures

The West Hartlepool Showrooms

The new showrooms and offices of the West Hartlepool Corporation Electricity Department were formally inaugurated on September 18th by Mr. A. C. Cramb, Director of E.D.A., supported by Mr. D. Maxwell Buist, manager for North-East England, Central Electricity Board. The premises have been taken over from a firm of furnishers and have been transformed into up-to-date showrooms. The exterior is illuminated by sign and facia lighting, while the showroom windows incorporate the Holophane method of applying white and coloured light to a window display. In the basement there is a workshop for the repair, &c., of domestic apparatus, and a storeroom. The main showroom is on the ground floor, where there is a display of an extensive range of lamps, lighting fittings, clocks, fires, bathroom fittings and electrical appliances. A fire similar to one installed in the Jubilee House is one of the permanent features of the scheme of decoration. The inquiry bureau and offices are on the first floor, where

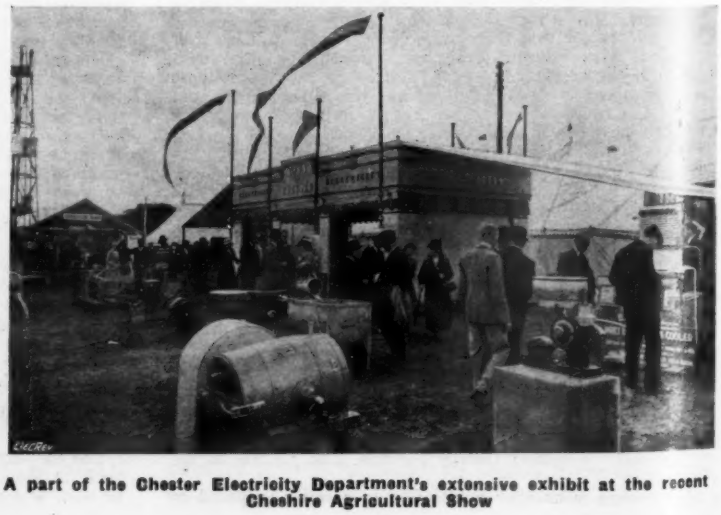
The new showrooms and offices of the West Hartlepool Corporation Electricity Department

vacuum cleaners are also demonstrated. On the second floor a kitchen and demonstration room has been provided. This has a stage on which there are a blackboard, sink, water heater and cookers. Another part of this floor has been arranged as a lighting service bureau, while demonstrations are also given of "sun-ray" lamps, &c.

At a luncheon which followed the opening of the premises, Mr. Cramb said that showrooms were essential in the development of an undertaking. Electricity should be looked upon as something that when it was brought into a house, introduced a new mode of living. E.D.A. had spent some time considering the question of introduction of electricity in the smaller homes where it was even more necessary and had prepared a report which would be valuable in assisting undertakings to employ the best methods of doing this. His thanks were due to Mr. S. Tillotson, the borough electrical engineer, for his help in the matter.

The Grocers' Exhibition

At the Grocers' Exhibition or, to give it its full title, the Grocery, Provision, Oil and Italian Warehouse and Allied Trades' Exhibition, now being held at the Royal Agricultural Hall, London, it is apparent that the grocery trade, like most others, is finding increasing uses for electrical equipment. The weighing of tea, flour, &c., can now be effected very rapidly and accurately by machines (made by the Automatic Weighing & Packing Co.), which are both driven and automatically controlled electrically, and Messrs. Southall & Smith, Ltd., have just perfected a combined envelope filling and sealing machine which will deliver filled and sealed packets at a speed of fifty or sixty a minute. Sifters, grinders and mixers are supplied by Messrs. Wm. Gardner & Sons (Gloucester), Ltd., while the tedious business of raisin stoning is made a simple matter by the "Xcedall" stoner (J. Collis & Sons, Ltd.). Cap-tightening machines of two designs are shown by the Metal Box Co., Ltd., electrically operated bacon-cutting machines being demonstrated by the Berkel & Parnall's Slicing Machine Manufacturing Co., Ltd., and G. A. Smith & Co. The Uno Co., Ltd., has a large range of coffee grinders and roasters, many of the latter employing electric heating elements and exhaust fans for cooling. At the stand of Messrs. Taylor & Backhouse, Ltd., who are now selling agents for both "Metrovick" and "Auto-Electric" electric delivery vehicles, Mr. Taylor told us that "electrics" are becoming increasingly popular among shopkeepers for local delivery service and that operating statistics for a 10-15-cwt. "Metrovick" model in daily use in the hilliest part of Sheffield showed that the cost for electricity at ½d. per kWh amounted to only 3s. 3d. per week. One of the vehicles shown is equipped with neon signs utilising the "Neoverter" system operated from a 6-V battery.



A part of the Chester Electricity Department's extensive exhibit at the recent Cheshire Agricultural Show

Employment in August

The September *Ministry of Labour Gazette* says that employment in most sections of the engineering industry continued to improve during August, and was moderate on the whole. It was fairly good in electrical engineering. The number of unemployed in the engineering industry fell by 4,660 to 111,196, *i.e.*, from 12.0 to 11.5 per cent. The proportion of unemployed in the electrical section remained stationary at 6.3 per cent. (7.2 per cent. in August last year). There was an increase in unemployed in the electrical wiring and contracting industry from 16.4 to 16.7 per cent. (the August, 1934, figure was 14.7 per cent.). In the electric cable, apparatus, lamps, etc., group there was an improvement from 7.7 to 7.1 per cent.—the same level as in August last year.

Vancouver Trade Commissioner's Visit

The Department of Overseas Trade announces that Mr. J. L. Wilson Goode, H.M. Trade Commissioner at Vancouver, is at present in this country on an official visit. Mr. Wilson Goode will be available at the Department of Overseas Trade from October 1st to 21st for the purpose of interviewing manufacturers and merchants interested in the export of United Kingdom goods to Western Canada. Between these dates he will visit a number of industrial centres in the provinces. Firms desiring an interview with Mr. Wilson Goode in London or information regarding the provincial centres he will visit should apply to the Department of Overseas Trade, 35, Old Queen Street, London, S.W.1, quoting reference 12689/35.

New Sutton Showrooms

The rebuilt showrooms and offices of the London and Home Counties Joint Electricity Authority at 52/54, High Street, Sutton, were opened yesterday.

Wages in the Cable-making Industry

The Joint Industrial Council for the Electrical Cable-Making Industry announces that the August 31st cost-of-living figure (43 per cent. above the 1914 level) will not involve any alteration in wages on the third pay-day in October.

Moulded Products Exhibition

A good idea of recent developments in plastic moulding was obtained this week at Grosvenor House, London, where Messrs. Thomas De La Rue & Co., Ltd., and Messrs. Charles Goodall & Son, Ltd., were holding an exhibition of some of their latest manufactures. In the electrical industry alone mouldings are now used for line insulators for power and telephone work, junction boxes, motor housings, meter covers, cut-outs, switches, lampshades, torch covers, clock cases, vacuum cleaner parts, radiant heat equipment, and hair dryers and wavers. A particularly interesting item was a telephone hand set chromium-plated direct on to bakelite, while another new product shown was an all-moulded exhaust fan (supplied by Winsor Axia Fans, Ltd.). It is probable that the radio industry would not have made such rapid progress re-

cently if it had not been for the attractive moulded cabinets now available, not to mention the formers, bobbins, &c., used in the receivers themselves.

Farming News

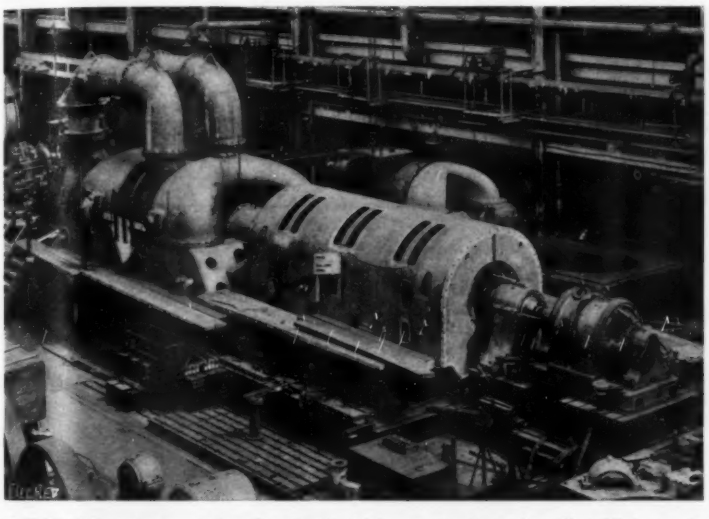
Current literature relating to farming is read by some electrical men because they want to learn as much as they can about that industry, and thereby get to understand the farmers' point of view as they approach rural electrification problems and projects. Other readers of the ELECTRICAL REVIEW do so because they find in such matter a subject of absorbing general interest. In the *Farmer and Stockbreeder*, which, like ourselves, is produced and published at Dorset House, both classes, and hosts of other people as well, have long found an almost inexhaustible mine of information, invaluable to both the farmer and his wife, but with the issue which will be on sale on Tuesday next, October 1st, our contemporary is making an important addition; this will take the shape of a 16-page photogravure supplement entitled "The Farmer's Home." Readers of the *Farmer and Stock-Breeder* will receive this supplement regularly without any advance in price (2d.).

Compulsory Regulations in New Zealand

The *New Zealand Electrical Journal* reports that after five years "hard labour" the revised electrical regulations for the Dominion have been completed. It has now been made an offence to manufacture, offer for sale, or sell any apparatus which does not comply with the requirements of the regulations. It is also an offence to install or use any material or apparatus not in accordance with the regulations. Power is given to prohibit the use of any appliance or apparatus considered hazardous.

The "Model Engineer" Exhibition

Apart from the electric locomotives this year's "Model Engineer" Exhibition now being held at the Horticultural



A 33,000-kW turbo-generator for South Africa on test at the Met.-Vick. works

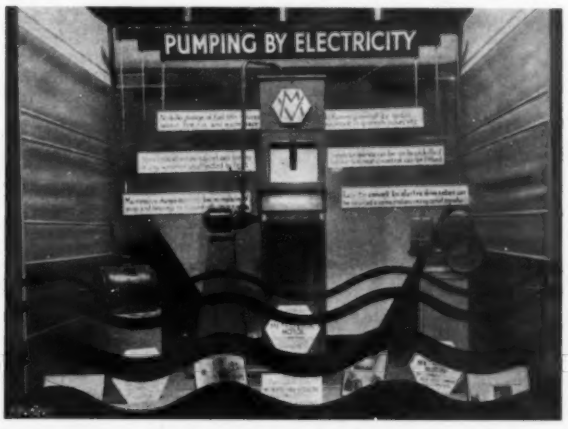
Hall, Vincent Square, London, has rather fewer exhibits of electrical interest than usual. A theatre stage demonstrating the three-colour lighting system, a 4-mm. model of a rectifier sub-station, and a scale model of an early ship's wireless outfit, are, however, three items which are attracting attention. Manufacturers of tools and electrical components are well represented and their exhibits include such articles as Desoutter drill guns, foot switches (Kingsway Electrical Services), grinding and polishing machines (Bond), power units for operating trains, etc. (Shenphone), "Alcosa" electric forges (Wm. Allday & Co., Ltd.), "Mekelite" adjustable lighting fittings (Mek-Elek Engineering, Ltd.), and "Grelco" motors, meters, adaptors, and water aerators (Grafton Electric Co.).

Two Lighting Booklets

Messrs. Crompton Parkinson, Ltd., have produced two interesting little booklets dealing respectively with domestic and industrial lighting. The former, entitled "The Crompton Story of Seeing," illustrates a number of domestic interiors, showing many types of electric lighting fittings in use, and advice is given on the number and size of lamps required to provide adequate illumination. The other publication, "The Crompton Book of Commercial Lighting," is in three sections dealing with manufacturing processes, offices and shops. Again typical examples of good lighting are illustrated and recommended minima for various establishments are set forth.

A Pumping Display

One of the Metropolitan-Vickers Electrical Co.'s Crown House (Aldwych) windows has been arranged to make a good case for the application of electricity to pumping. The central feature is an actual working model of a pump with coloured water falling from one tank to another, and just below this is a small ground-glass screen on which, by back projection, a continuously running message is thrown. A novel feature is the fact that the window glass has been incorporated as part of the display by having it painted with a symbolical



The application of electricity to pumping as portrayed in a Crown House, Aldwych, window

representation of water which attracts the eye without hiding the display to any appreciable extent.

Works Visit

On September 17th about sixty members of the Iron and Steel Institute visited many departments of the Trafford Park works of the Metropolitan-Vickers Electrical Co., Ltd. The visitors were informed that the company employs directly approximately 13,000 people and that all departments were fairly busy, orders at the rate of £20,000 a day being required to keep them so. Among other departments visited were the foundry, welding shop, electrical assembly shops and research department. In the high voltage research laboratory spectacular displays were given which included a 750,000-V 100,000-cycle discharge over a distance of 8 ft., and a million-volt 50-cycle discharge over a distance of 10 ft. In the mechanical and metallurgical laboratories the most notable exhibits were apparatus for investigating the creep of metals at high temperatures under simple and compound stresses, apparatus for photo-electric stress analysis, apparatus for vibration analysis and fatigue tests, equipment for magnetic testing for defects and exhibits showing the micro-structure of metals, and also showing the changes in micro-structure occurring during service at high temperatures. On the turbine and large electrical machine test beds the visitors saw a 33,000-kW 3,000 r.p.m. turbo-generator set erected with its generator for a combined test, this set being one of four in hand for the Victoria Falls and Transvaal Power Co. They also inspected a large rolling mill plant comprising two 2,900/9,000-h.p. 60/150 r.p.m. reversing motors, and a flywheel set comprising two 4,200-h.p. geared high-pressure turbines, a 28½-ton flywheel, two 2,400-kW 500-r.p.m. d.c. generators, and two 1,000-kW 500 r.p.m. d.c. generators. This set has been made for the Briton Ferry Steel Co. At the conclusion of the visit tea was served, during which the thanks of the visitors were expressed by Professor Sir Harold Carpenter, F.R.S., the President of the Institute, whose remarks were replied to by Sir Felix J. C. Pole, chairman of the company, and Mr. G. E. Bailey, general manager of works and director.

Orders Recently Booked

Messrs. Partridge Wilson & Co., Ltd., Leicester, have received an order from the Ormeau Bakery, Belfast, for a fleet

One of the Wilson vehicles supplied to a Belfast bakery

of fifty Wilson electric vehicles to replace horse transport. This order, valued at approximately £14,000, must be in the nature of a record.

An order for a further set of pumps to be installed at the Newnham pumping station of the Mid-Kent Water Co. has been placed with the Mirrlees Watson Co., Ltd., Glasgow. The plant includes two multi-stage turbine type combined borehole and booster pumps, two 22-kW generators and other items.

The Southern Rhodesia Customs Tariff

H.M. Trade Commissioner at Johannesburg reports that the Southern Rhodesia Tariff Commission, which has already expressed its willingness to receive from United Kingdom firms or bodies suggestions, and reasons therefor, for amendments to any tariff item, has now intimated its desire that these should be submitted through the Department of Overseas Trade, 35, Old Queen Street, London, S.W.1, and not directly to the chairman of the Commission as was stated in the previous notice. Firms intending to take advantage of this facility should, therefore, notify the Department immediately, in order that the Commission may be advised by telegram, while any who have written directly to the Commission should inform the Department and furnish a copy of their communication. The Commission will be open to receive evidence for about three more weeks only.

North London Exhibition

The High Commissioner for Southern Rhodesia (Mr. S. M. Lanigan O'Keefe) is to open the tenth North London Home Life Exhibition at the Alexandra Palace on October 9th. The exhibition will remain open until October 26th.

Acting for Charity

The accompanying picture is reproduced from a recent photograph of Green's Motors Dramatic Society composed of employés of Messrs. Horace Green & Co., Ltd., Cononley, near Keighley. The Society has its own producer, stage manager,

Green's Motors Dramatic Society

musical director, electrician, stage carpenters and scenic artists, and its object is the assistance of local charities. The proceeds of next month's productions are to go to the local Children's Playing Fields Committee.

The Birmingham Electric Club

The 1935-36 session of this Club opens this (Friday) evening at the Grand Hotel, Birmingham, when Messrs. H. R. Ruff and L. J. Davies will read a paper on "Modern Electric Discharge Lamps." The Council offers premiums of three guineas and two guineas for the best two papers submitted by members by December 31st. A selection from the papers received will be read at the February 21st meeting. A snooker handicap is being organised.

Other arrangements for the session are as follows.—October 18th, Ladies' Night; November 28th, "Recruiting for Industry"; December 13th, annual general meeting; January 24th, presidential address; March 6th, annual dinner; and March 20th, "Service Rendered by Electricity to Modern Medicine and Surgery," by Mr. B. Leggett, M.R.C.S., L.R.C.P.

The Polish Electrical Industry

The Polish Union of Electrical Manufacturers has recently asked the views of members upon the possibility of reducing imports of electrical products and increasing exports. Despite the difficulties in foreign markets, the value of the exports has risen from 830,000 zlotys in 1932 to 903,000 zlotys in 1933 and to 1,396,000 zlotys last year, and in the first half of 1935 the value has not been less than in the corresponding period of last year. On the other hand the imports are gradually declining. During the current year the value of the imports has so far amounted to 13,950,000 zlotys.

The Batti-Wallahs

The first luncheon of the new session of the Batti-Wallahs' Society will be held on October 8th at the Hotel Metropole, when the chief guest will be Mr. Frank Gill, O.B.E., chairman of Standard Telephones & Cables, Ltd.

An Installation Encyclopædia

A new 976-page catalogue issued by the General Electric Co., Ltd., is stated to deal with electrical installation material, but the term has been generously interpreted to include a wide range of equipment. Following information regarding the G.E.C. organisation, there are sections covering wires, cables and flexibles; wiring supplies; wiring systems; conduits and fittings; ironclad switchgear; line contact breakers, relays, &c.; switchboard accessories; lighting supplies; lamps; lighting fittings, fixtures and accessories; small transformers; measuring and testing equipment; motors and starters; fractional h.p. motors; bells and signalling apparatus; telephones; and fans. The catalogue also includes useful technical data and a comprehensive index.

"Elasta" Lamp Publicity

Pope's Electric Lamp Co., Ltd., has prepared a wide selection of "Elasta" lamp sales aids for the new lighting season. This includes a number of attractive showcards and display material, particular attention being paid to the company's coiled-coil lamps.

Advertisement Corrections

In the announcement of Messrs. Elliott Bros. (London), Ltd., on page 18 of our Advertisement Supplement last week, a maximum-demand recording ammeter was illustrated at a third of the actual size. By a printer's error this was stated to be one-eighth actual size.

In the advertisement of Messrs. Joseph Sankey & Sons, Ltd., in our last issue (page li) the company's London address was incorrectly given as 68, Regent Street, W.1, instead of 168.

Since Messrs. Henley's advertisement on page xv was printed the company has asked us to state that the photograph of Warkworth Castle is reproduced by courtesy of the North-Eastern Electric Supply Co.

Social Event

The first annual swimming gala of the Notting Hill Electric Sports Club was held at the Kensington Public Baths on Wednesday, 18th September, and proved a great success. Mrs. C. A. Franklin, wife of the chairman, presented the prizes to the winning competitors.

Prices of Materials

The following prices are only general, and they may vary according to quantities and other circumstances:—

CHEMICALS, ETC.	Price, Sept. 25th.	Fortnight's Inc. or Dec.
a Acid, Oxalic ... ... per cwt.	50s.	—
a Ammoniac, Sal ... ... per ton	£36	—
a Ammonia, Muriate (large crystal) ... ,,	£18 10s.	—
a Borax ... ... ,,	£17	—
a Copper, Sulphate ... ... ,,	£15 10s.	—
a Potash, Chlorate ... ... per lb.	3¾d. to 4¼d.	—
a ,, Perchlorate ... ... ,,	6d.	—
a Shellac ... ... per cwt.	£4 18s.	—
a Sulphur Commercial... ... ... per ton	£11	—
a ,, Roll ... ... ,,	£11	—
a Soda Chlorate ... ... per lb.	3½d. to 3¾d.	—
a ,, Crystals... ... ... per ton	£5 to £5 5s.	—
a Sodium Bichromate, casks ... ... per lb.	4d. nett.	—
METALS, ETC.		
b Aluminium, Ingots ... ... per ton	£100 to £105	—
b ,, Wire ... ... per lb.	1/1 to 1/9	—
b ,, Sheet and Foil... ... ... ,,	1/2 to 2/9	—
p Babbitts Metal and Anti-friction Metals—		
Grade I ... ... per ton net	£206	£3 inc.
Grade II ... ... ,,	£142	£2 inc.
Grade III ... ... ,,	£73	—
c Brass (rolled metal 2" to 12" basis) per lb.	7¼d.	½d. inc.
c ,, Tubes (solid drawn) ... ... ,,	9½d. to 9¾d.	½d. inc.
c ,, Wire, basis ... ... ,,	7¾d.	½d. inc.
c Copper Tubes (solid-drawn) ... ,,	10½d.	½d. inc.
g ,, Bars (best selected)... ... per ton	£66	£2 inc.
g ,, Sheet ... ... ,,		
g ,, Rod ... ... ,,		
d ,, (Electrolytic) Bars ... ... ,,	£39 10s.	£1 15s. inc.
d ,, ,, Wire Rods ... ,,	£44	£1 5s. inc.
d ,, ,, H.C. Wire ... per lb.	7½d.	¼d. dec.
f Ebonite Rod ... ... ,,	1/6 to 2/- plus	—
f ,, Sheet ... ... ,,	1/3 to 1/6 10%	—
n German Silver Wire ... ... ,,	2/5	—
h Gutta-percha, fine ... ... ,,	nom.	—
h India-rubber, Para-fine ... ... ,,	4¼d.	—
i Iron, Pig. (Cleveland No. 3) ... per ton	67/6	—
i ,, Wire galv. No. 1, P.O. Qual.... ,,	£20	—
g Lead, English Pig ... ... ,,	£18 5s.	½s. inc.
g Mercury ... ... per bot.	£11/7/6 to £11/17/6	—
e Mica (in original cases) small ... per lb.	6d. to 1/-	—
e ,, ,, medium ... ,,	5/- to 10/-	—
e ,, ,, large ... ,,	10/6 to 17/6 up	—
p Phosphor Bronze, plain castings ... ,,	1/1	—
p ,, ,, drawn bars & rods ,,	11½d.	¼d. inc.
p ,, ,, rolled strip & sheet ,,	11d.	¼d. inc.
p ,, ,, wire ... ... ,,	1/0½	¼d. inc.
o Platinum ... ... per oz.	£7 10s.	—
d Silicium Bronze Wire ... ... per lb.	8½d.	½d. inc.
r Steel, Magnet, in bars ... ... ,,	7½d.	—
g Tin, Block (English) ... ... per ton	£224	£5 10s. inc.
n ,, Wire, Nos. 1 to 16 ... ... per lb.	3/5	—

Quotations supplied by:—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India Rubber, Gutta Percha, and Telegraph Works Co., Ltd.
g Henry Gardner & Co., Ltd.
h Edward Till & Co.
i Bolling & Lowe.
n P. Ormiston & Sons.
o Johnson Matthey & Co.
p C. Clifford & Sons, Ltd.
r W. F. Dennis & Co.

The above table is published here fortnightly. In alternate issues, in which it does not appear, the latest prices of copper, silicium bronze wire, lead and rubber, up to the time of going to press, are given in our "Business Notes" under the same heading.

Australian "Dumping" Duties Removed

The Commonwealth Government has removed "dumping" duties on a number of articles as from August 16th, including the following:—Fuse boxes, knife switches, ironclad cut-outs and static transformers, exported from the United Kingdom.

"Electrics" for Milk Delivery

A fleet of electrically driven milk vans has recently been put into service by the Manchester and Salford Co-operative Society. These vehicles were supplied by Electricars, Ltd., and are equipped with Tudor batteries of 30 cells, each of a capacity of 226 Ah. The charging equipment consists of a metal rectifier, supplied by the Westinghouse Brake & Signal Co., Ltd.

Local Exhibitions

The Shipley Urban District Council Electricity Committee has arranged an exhibition of domestic and other electrical appliances to be held at the Victoria Hall, Saltaire, from September 28th to October 5th.

The Blackburn Corporation Electricity Department has arranged an electrical exhibition, the first of its kind to be held in the town since 1905. It will open to-day (Friday) and will continue until October 5th. Features of the exhibition will include films, demonstrations, an electric bungalow, and an electric café.

In the Building Trades Exhibition, which opened at the New Renshaw Hall, Liverpool, on September 24th, and will continue until October 5th, the Liverpool Corporation Electric Supply Department has a large stand on which is shown a range of electrical appliances. The General Electric Co., Ltd., is displaying street lighting equipment "Osram" lamps, "Osira" colour floodlights, S.G.E. traffic signalling equipment and automatic telephones, while the Fraser & Chalmers Engineering Works is exhibiting mechanical equipment representative of its products.

Trade Announcement

The Euston Electrical Supplies is removing on September 30th to 16, Hampstead Road, N.W.1.

The "Cosmos" Calendar

An attractive blonde adorns the 1935-36 "Cosmos" lamp calendar which we have received from the Metropolitan-Vickers Electrical Co., Ltd. While the same type of subject as in previous years has been retained, the make-up of the calendar has been altered. Each of the daily tear-off slips bears a quotation.

For Sale

Warrington Corporation Health Committee offers for sale the complete lighting equipment at Hefferston Grange Sanatorium, Weaverham.

Sheffield Corporation Electricity Department invites tenders for water-tube boilers, &c.

(See our classified advertisements.)

The S.C.W.S. and Lamp Production

The Glasgow Correspondent of the *Financial Times* reported last week that the Scottish Co-operative Wholesale Society was to carry through development schemes costing about £185,000, and that the Society was considering the question of manufacturing electric lamps. An inquiry addressed by us to the Society has elicited the statement that "we have no information in regard to the manufacture of electric lamps which we think would be of interest to your readers."

Illumination Design Course

The thirty-second Illumination Design Course arranged by the Electric Lamp Manufacturers' Association will be held on Monday evenings from October 14th to November 18th, when lectures will be given by Messrs. W. J. Jones, B. P. Dudding, J. W. Howell, L. J. Davies, H. Lingard, and R. O. Sutherland.

New Catalogues and Lists

National Lighting Co., Ltd., 19, St. Bride Street, E.C.4, has issued a catalogue of lighting fittings, lampshades, &c.

Mavor & Coulson, Ltd., 47, Broad Street, Glasgow, S.E., have published illustrated booklets on mining machines, a 15-in. coalcutter and plant for trackless mining.

Wild-Barfield Furnaces, Ltd., Elecfurn Works, North Road, Holloway, N.7.—A new art catalogue of works and laboratory furnaces, detailing several new models.

F. W. Lechner & Co., Ltd., 61, Spencer Street, Clerkenwell, E.C.1.—Particulars of "Kaki" components, introducing new duplex carbon potentiometers.

Engineering & Lighting Equipment Co., Ltd., Sphere Works, St. Albans.—A folder giving details of fittings for electric discharge lighting.

M. & C. Switchgear, Ltd., Kelvinside Works, Kirkintilloch, Glasgow.—Pamphlet No. R61/2A on an a.c. push-button starter for "straight-on" starting.

F. J. Gordon & Co., Ltd., 114, Euston Road, N.W.1.—Two leaflets relating to rectifiers for battery charging.

Unity Heating, Ltd., Vincent House, Vincent Square, Westminster, S.W.1.—A new season's catalogue of low-temperature heating apparatus.

Wholesale Fittings Co., Ltd., 23-27, Commercial Street, E.1.—A copy of a new 103-page accessories catalogue has been received.

Higgs Motors, Ltd., Birmingham.—A pocket stock list of motors and dynamos.

L. G. Hawkins & Co., Ltd., 30-35, Drury Lane, Kingsway, W.C.2.—Leaflets on new domestic appliances.

"Typerlite" Co., 85, Cannon Street, E.C.4.—A catalogue of "Typerlite" fittings.

British Thomson-Houston Co., Ltd., Rugby.—A leaflet on type "C" peg cap holders.

The Manchester and Salford Co-operative Society's fleet of electric milk vans

Dussek Bitumen & Taroleum, Ltd., Empress Wharf, Bromley-by-Bow, E.3.—A catalogue on "Trinidite" bitumen composition for mechanical protection.

Falk, Stadelmann & Co., Ltd., 83-93, Farringdon Road, E.C.1.—Two catalogues of labour-saving devices for the home and electric fires.

British Insulated Cables, Ltd., Prescot.—A list of cables supplied for working voltages of from 20,000 to 25,000.

Northern Steel & Hardware Co., Ltd., 7, Gartside Street, Manchester, 3.—A catalogue of radio receivers.

Company Liquidations

Harris's (Southend), Ltd., radio dealers, 20, Barking Road, East Ham, E.6.—The statutory meeting of creditors was held on September 16th at East Ham, when a statement of affairs was submitted which showed ranking liabilities of £1,342 and net assets of £384, leaving a deficiency of £958. There were also contingent liabilities of an unascertained amount. The creditors passed a resolution for the appointment of Mr. W. A. J. Osborne, Balfour House, Finsbury Pavement, E.C., as liquidator of the company with a committee of inspection. The following are the principal creditors: Marconiphone, Ltd., £424; United Dominions Trust, Ltd., £262; Pye Radio Co., Ltd., £118, and Regentone Products, Ltd., £105.

Economic Household Appliance Co., Ltd.—Meeting October 17th at 196-8, High Street, Stoke Newington, to receive an account of the winding-up from the liquidator, Mr. A. W. Hardwick.

Bankruptcy Proceedings

William Hodge, 3, Saltash Street, Plymouth, electrical engineer.—The public examination was held recently at Plymouth. In reply to the Official Receiver, debtor stated that his deficiency was £394. He had commenced business in December, 1918, with a capital of £217. His trading proved successful, and by March, 1927, the capital had been increased to £6,817. In 1925 a profit of £3,300 was earned on sales of £11,000. From 1927, however, the business gradually declined owing to competition. Debtor's drawings during the last few years had far exceeded the profits, and he admitted not having paid proper attention to the business. The examination was adjourned.

Morton Morris, 3, Thornhill Road, Plymouth, wireless dealer.—The public examination of this debtor was held recently at Plymouth, when the liabilities were stated to be £1,395 and there were no assets. The examination was closed.

W. B. Ralphs, electrical contractor, 30, Ayresome Street, Middlesbrough.—Last day for receiving proofs for dividend October 5th. Trustee, Mr. C. L. Townsend, 80, High Street, Stockton-on-Tees, Official Receiver.

F. F. C. Evett (Radiofans Services), wireless and electrical contractor, 28, Flottergate, Great Grimsby.—Trustee, Mr. J. F. Wintringham, St. Mary's Chambers, Great Grimsby, Official Receiver, released August 20th.

E. H. Jones, electrician and radio dealer, Northcote Buildings, Undercliffe, Bradford.—Trustee, Mr. F. H. Langmaid, 71, Manningham Lane, Bradford, Official Receiver, released August 9th.

H. P. Baker (M. H. Baker & Son), electrical contractor, 9, Station Road, Walthamstow.—Trustee, Mr. E. Parke, Bankruptcy Buildings, Carey Street, W.C.2, Senior Official Receiver, released August 14th.

H. E. Hewitt, electrical engineer, 55, Park Road, Hornsey, N.8.—Trustee, Mr. S. W. Hood, Bankruptcy Buildings, Carey Street, W.C., released August 6th.

J. H. Withycombe, electrical engineer and wireless dealer, 61, High Street, Barnstaple.—Trustee, Mr. W. P. Hatton, The Strand, Barnstaple, released August 27th.

H. Hillier-Brook, radio engineer, 4, Market Street, Otley.—Trustee, Mr. H. C. Bowling, 24, Bond Street, Leeds, Official Receiver, released August 13th.

C. Mellanby, radio engineer, Penlan Street, Pwllheli.—Trustee, Mr. I. D. Hooson, St. Peter's Churchyard, The Cross, Chester, Official Receiver, released August 23rd.

B. A. E. Hinkins, radio dealer, 322, Torquay Road, Paignton.—Receiving order made September 13th on debtor's own petition.

Electricity Supply

Lighting, Domestic, Power

Abertillery.—DEVELOPING THE UNDERTAKING.—The Electricity Commissioners have sanctioned the expenditure of £22,000 on the development of the Council's electricity undertaking in the lower part of the urban area. A change-over scheme has been under consideration for some time, and it is proposed to convert the present overhead system to an underground one.

Australia.—WESTERN AUSTRALIAN ELECTRICITY SUPPLY.—In his annual statement on the Electricity Supply Department, Mr. J. C. Willcock, Western Australian Minister for Railways, shows that for the year ended June 30th last there was a profit of £40,459. The earnings were £324,973, as compared with £297,248 last year, while working expenses totalled £222,856 (£193,590). During the year the Department sold 87,416,701 kWh, an increase of 7,506,086 kWh.

Aylesbury.—NEW LINK LINE.—The Town Council has decided to erect a link line to Halton at an estimated cost of £1,325, and to give a supply to the Akeman Street Brick Works at an outlay of £1,000. A Fringe Order to supply outside Speen is to be applied for.

Bolivia.—IMPORTANT HYDRO-ELECTRIC SCHEME.—The Bolivian Government has signed a contract with the Hochschild Company, a South American development organisation, for the construction at Titicaca Lake, 12,500 ft. above sea level, of one of the biggest hydro-electric plants in Latin America, according to a special cable to the *New York Times* from La Paz, Bolivia. The plant will be able to supply electricity not only to Bolivia, but also to neighbouring countries. The contract calls for an investment by the company of $25,000,000, and the work is to take five years. The Government will receive 5 per cent. of the gross earnings of the plant. The company contemplates the complete drainage of Lake Titicaca towards Sorato, 6,400 ft. above sea level, where the plant will be built. It is expected that the plant will allow of the electrification of the Bolivian railways, as Bolivia does not produce coal.—*Reuter's Trade Service.*

Boston.—ELECTRICITY FOR WATER PUMPING.—The Town Council has sealed an agreement with the Mid-Lincolnshire Electric Supply Co., Ltd., for a supply of electricity to the water-pumping station at Fordington.

Bradford.—EQUIPMENT FOR AN AERODROME.—The Corporation is seeking sanction to borrow £2,000 for the provision of equipment in order to facilitate night flying at the aerodrome.

Brighton.—SUB-STATIONS.—The Electricity Committee has acquired two further sub-station sites on the Saltdean Estate.

SUPPLY EXTENSION.—A supply is to be provided to the Windmill Estate, Southwick (£5,619); and to Fulking (£891). Mains are also to be extended at a cost of £3,856. For additional cables and works in connection with the laying of cables across the canal at Southwick a loan of £2,600 is required.

ELECTRIC COOKING.—The General Purposes Committee has asked the Electricity Department to arrange for the installation of electric cookers in 68 small houses on the Manor Farm Estate.

Cardiff.—YEAR'S PROGRESS.—The city electrical engineer, Mr. C. G. Morley-New, stated recently that the electricity department had made considerable progress during the year ended March 31st last. During that period the total revenue of the department amounted to £324,272, as compared with £302,153 in 1933-34, while the number of consumers increased from 45,298 to 48,452, with a corresponding increase in the connected load from 130,130 kW to 148,594 kW. The operating costs at the generating station reached the lowest level in the records of the undertaking, the cost per kWh being 0.198d., as against 0.216d. in the previous year. There was an increase of more than 9,000,000 kWh in sales to local consumers; the only section which showed a slight decrease was the supply to the tramways, due to the substitution of buses. The sum of £12,863 had been appropriated for the relief of rates, bringing the total contribution from the electricity undertaking during the past fourteen years to £290,374. The number of cookers connected increased from 865 to 1,737, bringing the total on circuit to 3,841.

Carlisle.—ELECTRICITY FOR PUMPING PLANT.—The City Council is to supply electricity to the Floristan pumping plant of the London and North-Eastern Railway Co., Ltd.

Ceylon.—ELECTRICAL PROGRESS.—Electricity is making headway in Ceylon, and during the last year, according to Major C. H. Brazel, director of electrical undertakings, the Department of Electricity showed satisfactory progress. Mr. Brazel states that the mains will require extensive renewals, in view of the change of voltage from 100 to 230 V. This standardisation of voltage of supply is bound to remove an impediment to the more general use of electricity. During the year under review the extension of the system of supply in new streets and areas in Colombo was proceeded with and about 8,250 yd. of overhead and underground mains extensions were laid and put into service and 704 new installations connected.

Government Contracts

THE following contracts were placed by various Government Departments during August:—

ADMIRALTY.

Motor alternators.—Newton Bros. (Derby); W. Mackie & Co.
Electric cable.—Hooper's T. & I.R. Works; St. Helen's Cable & Rubber Co.; Hackbridge Cable Co.
Electrically driven capstan gear.—Clarke, Chapman & Co.
Contactors.—Everett, Edgcumbe & Co.
Electric lighting and power installation.—G. E. Taylor & Co.
Table fans.—G.E.C.; Veritys.
Steam driven electric generator.—W. H. Allen, Sons & Co.
Switchboards.—Whipp & Bourne.
Switches, etc.—Engg. & Lightg. Equipment Co.; W. McGeoch & Co.; Player, Mitchell & Breeden; G.E.C.
Electric trucks.—Wingrove & Rogers.
Electrically driven winches.—Cowans, Sheldon & Co.; Stothert & Pitt.

WAR OFFICE.

Charging boards.—Veritys.
Submarine cable.—Siemens Bros.
Secondary portable cells.—Pritchett & Gold & E.P.S. Co.
Inert cells.—Siemens Bros.; Britannia Batteries.
Electric fans.—Veritys.
Switchboards.—Ferguson Pailin; Dorman & Smith.
Electric lifts.—Evans Lifts.

AIR MINISTRY.

Accumulators.—Milnes Radio Co.
Alternator sets.—Davey, Paxman & Co.
Ammeters, voltmeters and wattmeters.—Everett, Edgcumbe & Co.
Batteries.—Siemens Bros.; Britannia Batteries; Ever Ready Battery Co.
Electrical services, Eastleigh: Burch & Vertue; Colston Electrical Co.
Electric cable.—Connolly's (Blackley).
Conduits and fittings.—Walsall Conduits.
Conversion sets.—Dunlop Rubber Co.
Generators.—Newton Bros. (Derby); Rotax.
Magneto spares and motor control gear.—B.T.H.
Radio link.—Plessey Co.
Receiver d.f. and spares.—Marconi's.
W.t. valves.—A. C. Cossor.
Wavemeters.—H. W. Sullivan.

POST OFFICE.

Telegraphic apparatus.—Creed & Co.
Telephonic apparatus.—Automatic Electric Co.; Ericsson Telephones; G.E.C.; Huntley Boorne & Stevens; Muirhead & Co.; Phœnix Telephone & Electric Works; Siemens Bros.; Standard Telephones; Telephone Mfg. Co.
Testing and protective apparatus.—Evershed & Vignoles; H. W. Sullivan; Westinghouse Brake & Signal Co.
Wireless apparatus.—G.E.C.; Hewittic Electric Co.
Leclanché battery boxes.—Duncan Tucker (Tottenham).
Cable.—Connolly's (Blackley); W. T. Glover and Co.; Hackbridge Cable Co.; Henley's.
Loading coils.—Automatic Electric Co.; G.E.C.; Siemens Bros.; Standard Telephones.
Telephone cords.—B.I. Cables; London Elect. Wire Co. & Smiths; L.P.S. Electrical Co.; Phœnix Telephone & Elect. Works; Reliance Elecl. Wire Co.; Siemens Bros.; Standard Telephones.
Diaphragms.—Baldwins.
Electric lighting fittings.—Hailwood & Ackroyd; Venner Time Switches.
Electric lamps.—H. Miller & Co.
Cabling and loading coils.—Tunbridge Wells-East Grinstead-Uckfield; Newcastle-upon-Tyne-Alnwick; Crediton-Barnstaple; Junction, Market Harborough-Northampton: United Telephone Cables. Sub-contractors for loading coils.—Standard Telephones; Automatic Electric Co.; Salford Elecl. Instruments.
Electric lifts.—Aberdeen; Birmingham Telephone House & Head Post Office: Express Lift Co. London, Mount Pleasant Parcel Sorting Office: W. Wadsworth & Sons.
Electric lighting.—Birmingham Fordrough Lane, P.O. Stores: B. French.
H.p. and l.p. switchgear and transformer apparatus.—Fenny Stratford: Northampton Electric Light & Power Co.
Telephone exchange equipment.—Norton-on-Tees (Middlesbrough); Edgware; Kings Langley: G.E.C. Newton (Mont); L.C.C. County Hall, London; Worcester; Plymouth; Widnes: Automatic Electric Co. Bushey Heath (London); London Trunk Exchange; Seaford: Standard Telephones. Sub-contractors for Bushey Heath: Hart Accumulator Co. for batteries; Electric Construction Co. for motor generators; W. Jones & Co. for ringing machines. Sub-contractors for Seaford: Tudor Accumulator Co. for batteries; Electric Construction Co. for generators. Prestwick (Ayr); Smethwick (Birmingham); Ericsson Telephones.
Telephonic repeater equipment.—Hull; Belfast; Leeds: Standard Telephones. Fenny Stratford: G.E.C. Sub-contractor: Chloride Electric Storage Co. for batteries.

H.M. OFFICE OF WORKS.

Experimental wiring.—Photometry Building, National Physical Laboratory: R. Langston-Jones & Co.
Storage batteries.—National Physical Laboratory: Britannia Batteries.
Rewiring of electric lights, Royal Courts of Justice: Malcolm & Allan (London).

CROWN AGENTS FOR THE COLONIES.

Cell signal system for cell blocks.—J. Sax & Co.
Cable.—B.I. Cables; Siemens Bros.
Electric derrick crane.—Anderson Grice Co.
Lighting equipment for aerodrome and telephone exchange equipment: G.E.C.
Meters.—B.I. Cables.
Telephone cable.—Henley's.
Wireless apparatus.—Standard Telephones.

The Department completed during the year three electric lighting schemes, namely, Gampola, Polyahewala and Anuradhapura, and handed them over to local authorities, and schemes for Waragoda, Kuliapitia and Pusseleeawa were commenced during the year. Proposals to give a supply of electricity to Hatton-Dikoya from the plant at Norton Bridge were considered, and it is contemplated that an early start will be made with the erection of the 33-kV line, which will also serve the tea estate factory load *en route*. This line will be capable of being incorporated into the e.h.v. transmission system in the tea area when the hydro-electric scheme is completed.

Clitheroe.—OVERHEAD LINE.—The Town Council has secured wayleaves for an overhead line to supply electricity to Newton.

LOWER CHARGES.—The charge for all lighting supplies is to be reduced to 5d. per kWh, instead of 6d. per kWh for the first 100 kWh per quarter and 5d. above that amount. On the all-in rate, or two-part tariff, electricity will be charged at ½d. per kWh. A reduction of 5s. per lamp per annum is recommended for all public lamps, and modifications have been made in power charges.

Coventry.—EXTENSIONS TO POWER STATION.—The Electricity Committee is seeking sanction to borrow £306,000 for power station extensions in accordance with a direction of the Central Electricity Board.

NEW MAINS.—The Electricity Committee is to extend mains and plant at a cost of £6,769.

Derby.—CONCESSION TO CONSUMERS.—The Corporation, in celebration of the local government centenary, proposes to reduce all standing charges to domestic consumers by 2½ per cent. This concession will make the prices of electricity in Derby the lowest in the Central England area. The "business tariff" will be reduced from ¾d. to ½d. per kWh.

Exeter.—STREET LIGHTING.—The Electricity Committee is to convert street lighting at Heavitree to electricity at a cost of £505.

DOCK LIGHTING.—Tenders are to be obtained by the Navigation Committee for a lighting installation at the Double Locks Hotel and also for the lighting of Double Locks.

France.—SIX MONTHS' OUTPUT.—According to the *Revue Générale de l'Electricité* the output of the sixty-eight principal electric power stations, representing about 94 per cent. of the total French production, during June last amounted to 858,807,645 kWh, bringing up the aggregate output during the first six months of the year to 5,312,283,340 kWh, as compared with 5,268,526,965 kWh in the corresponding period of 1934, an increase of 0.83 per cent. Hydro-electric stations were responsible for 3,537,162,125 kWh.

Germany.—RADIO RECEIVERS AS A DOMESTIC LOAD.—In a recent issue of the *Osram Nachrichten* it is estimated that out of the 5½ million radio receiving sets in used in Germany 500,000 are of the crystal type, 2 million are operated by batteries, while 3 million are all-electric. With the last number as a basis, our German contemporary estimates that, taking 40 W as the average consumption of a receiving set for 3 hours every day of the year, the consumption of electric power amounts to no less than 131,400,000 kWh per annum. Adding to this the power used in recharging the accumulators of battery sets, the amount of power consumed by radio receivers in Germany amounts to over 150 million kWh per year. The same journal estimates that in the United States the various power stations supply over 850 million kWh per year for radio receiving set operation, and that the world consumption for the same purpose is not less than 2,250 million kWh per annum.

Grimsby.—SUPPLY EXTENSION.—A supply is to be given to East Ravendale at a cost of £748.

Guisborough (Yorks).—APPARATUS ON HIRE.—A recent decision by the Urban District Council is that electric cookers and boilers shall be let out on simple hire, the quarterly charge to be at the rate of 6d. in the £ of the net cost of the appliance.

Halifax.—PROGRESS DURING JULY AND AUGUST.—Mr. G. A. Vowles, the borough electrical engineer, reports that the increase in electricity sold by the undertaking over the previous year in respect of the months July and August was 17.7 per cent. and 11.7 per cent. respectively, while the aggregate from April 1st showed an increase of 14.4 per cent., and had it not been for the reduction in electricity used by the tramways this would have been 20.1 per cent. The fuel consumption shows a decrease of 21.4 per cent. and 12.8 per cent. for July and August respectively, while the cost per kWh generated was reduced by 23.9 per cent. and 16.5 per cent. The output of appliances also showed satisfactory progress, that of cookers for the two months being 163, washboilers 101, water heaters 15, and immersion heaters 54. In connection with the Shopping Festival the Committee agreed to floodlight Wainhouse Tower on similar lines to the Jubilee Celebrations and also to lend to shopkeepers strip lighting free of cost provided they defrayed the cost of erection and dismantling.

Hartley Wintney.—OVERHEAD LINES.—The Rural District Council has withdrawn its opposition to the erection of overhead lines at Odiham and Hartley Wintney by the Mid-Southern Utility Co., Ltd., on condition that underground mains are laid in a portion of the High Street at Odiham.

Kingston-on-Thames.—LOWER LIGHTING CHARGES.—The Town Council is reducing its electric lighting rate from 3½d. to 3d. per kWh.

Kirkcaldy.—SUPPLYING COUNCIL HOUSES.—The Transport and Electricity Committee has considered the question of supplying the houses to be erected on the King Street site with electricity. The electrical engineer reported that about half the area proposed to be acquired to the north of the present site was outside the Corporation's electricity supply area, and that the houses to be erected there would require to be supplied with electricity by the Fife Electric Power Co., whose charges were more than double those of the Corporation. It was agreed to meet the Fife Electric Power Co. and endeavour to acquire from it the right to supply the houses in question.

Larbert (Stirlingshire).—INQUIRY INTO CHARGES.—Residents have appointed a committee to inquire into the charges for electricity with powers to negotiate with the Scottish Midlands Electricity Supply Co. with a view to securing a reduction.

London.—STOKE NEWINGTON.—The Electricity Committee recommends that rising mains be provided to the upper floors of the block of flats to be erected by the L.C.C. on the Glebe Place site at the entire cost of the Electricity Department, and, further, that rising mains be provided at the cost of the Department in future in all other cases where flats are built in blocks.

Lowestoft.—OIL-PURIFYING APPARATUS.—Oil-purifying apparatus is to be bought by the Electricity Committee at an estimated cost of £185.

LOANS.—Sanction has been obtained to borrow £12,000 for meters, £625 for the supply to Gisleham, and £5,000 for buildings and plant.

Manchester.—BARTON TO BE EXTENDED.—Extensions are to be carried out at Barton power station at a cost of £470,000. The work is to be commenced immediately, although the plant, which will include a 50,000-kW generating unit, will not be in operation before 1938.

HIRE CHARGES.—Reductions of 1s. 6d. per quarter in the hire charges for electric wash-boilers and 1s. per quarter for water heaters are recommended by the Electricity Committee, making wash-boilers available at 2s. 6d. to 3s. per quarter and water heaters at 2s. 9d. to 4s.

Morocco.—HYDRO-ELECTRIC SCHEME.—The Société d'Energie Electrique du Maroc has invited tenders for the supply and installation of the plant for a new hydro-electric station to utilise the water power of the River Oued N'Fis in Morocco.

North Wales.—A TARIFF QUESTION.—At a meeting of the North Wales and South Cheshire Local Authority Electrical Undertakings' Association it was stated that the North Wales Power Company had offered to make concessions in indirect supplies from the grid, the offer being a three-part tariff involving a fixed annual rent, plus a kW charge and a "unit" rate. The value of the concession was put at £4,400 per annum for a period of five years. A resolution was adopted recommending constituent authorities now taking bulk supplies from the North Wales Power Co. to accept the terms offered, subject to an understanding that such acceptance would not prejudice any action which the authorised undertakers might take in endeavouring to remedy the conditions for North Wales and South Cheshire under the national grid scheme.

Oundle.—OVERHEAD LINES.—The Mid-Lincolnshire Electric Supply Co., Ltd., has obtained sanction from Oundle and Thrapston Rural District Council for the erection of overhead h.v. lines in Woodnewton, Nassington and Yarwell.

Portland.—MUSEUM HEATING.—Tenders are to be obtained by the Urban District Council for electric lighting and tubular heating at the museum.

LOANS.—The Electricity Committee is seeking sanction to borrow £2,000 for mains and services, £500 for sub-station equipment, £1,200 for meters and £2,500 for hire-purchase apparatus.

STREET LIGHTING.—Arrangements have been made for electric street lighting in the vicinity of the Borstal Institution by the Electricity Committee.

Rawtenstall.—SUPPLY TO DUNNOCKSHAW.—Powers have been granted for the electricity undertaking to supply Dunnockshaw. Requests have also been received for a supply to Habergham Eaves, and the Burnley authorities are to be consulted.

Redcar (Yorks).—BULK SUPPLY.—The Town Council has entered into a new agreement with the North-Eastern Electric Supply Co. for a bulk supply of electricity. The new terms show a considerable reduction in the "unit" charges.

SUPPLY TO HOUSING ESTATE.—The sanction of the Electricity Commissioners has been received by the Town Council for the supply of electricity to a number of houses on the Coast Road Estate.

South Africa.—EXTENSIONS AT BLOEMFONTEIN.—Plans are being prepared for extensions to the Bloemfontein power station at a cost of about £100,000. The ratepayers have voted on electricity account a sum of £130,000, which provides for the installation of a 6,000-kW generating set, additional pumps, mains extensions, and other improvements. The output will be increased by about two-thirds, and the additional plant is expected to ensure an adequate supply of electricity for the next twenty years.

COMPLETION OF PRETORIA EXTENSIONS.—The extensions to the Pretoria power station, which have been in progress for several months at a cost of £250,000, have been completed and will be officially opened on October 12th.

Spalding.—EMERGENCY CABLE.—Work is in progress on the laying of a new four-mile emergency cable from Surfleet grid station to Spalding.

Sunderland.—SUB-STATION.—Plans have been approved for the erection of a sub-station in Cato Street for the North-Eastern Electric Supply Co.

Swansea.—NEW CABLE.—The Electricity Committee is to replace the overhead cable from the Strand Station to Tir John by an underground cable at a cost of £10,288.

Thingoe.—WIRING OF HOUSES.—The Rural District Council has arranged with the East Anglian Electric Supply Co. for the wiring of houses at Ixworth and Stanton. There are to be five points in each house.

Tobermory (Mull).—LIGHTING EXTENSION.—The extension to the present electric lighting installation in Tobermory was inaugurated on September 18th.

Twickenham (Middlesex).—NEW MAINS.—The London and Home Counties Joint Electricity Authority has notified the Town Council of its intention to lay new mains along portions of The Barons, St. Margaret's Road, Chertsey Road, London Road, and Fulwood Gardens.

Ventnor (I.O.W.).—OPPOSITION TO OVERHEAD LINE.—The Urban District Council has decided to oppose an application by the Isle of Wight Electric Light & Power Co. for permission to erect an overhead line at St. Lawrence. A committee had recommended that no objection should be raised.

Wakefield.—ELECTRICITY IN COUNCIL HOUSES.—The Housing Committee has recommended the City Council to approve a scheme under which, in future, all municipal houses would be equipped as all-electric houses, except for the provision for a gas ring; tenants desiring further gas equipment would have to provide it at their own expense and replace the electrical appliances on terminating their tenancy. Gas interests in the city are opposing the scheme, and the City Council has referred it back to the General Purposes Committee.

Wanstead-Woodford.—OVERHEAD LINE.—Consent has been given by the Urban District Council to the Ilford Town Council for the erection of an overhead line at Wanstead to supply the higher grade school sports pavilion with electricity.

Traction

Australia.—WESTERN AUSTRALIAN TRAMWAYS.—A statement issued by Mr. J. C. Willcock, Western Australian Minister for Railways, shows that the capital account of the Tramway Department at June 30th last was £1,104,572, a decrease of £16,557 as compared with the previous year. Operations for the past year resulted in a profit of £5,725, against a loss of £4,116 a year ago. The total earnings were £284,673, compared with £280,214; and working expenses were £227,074, against £232,188. The car-miles totalled 3,414,932, an increase of 30,923, and the number of passengers carried was 29,923,144, an increase of 391,875.

Estonia.—RAILWAY EXTENSIONS.—According to Continental papers quoted by *Reuter's Trade Service* the Estonian Railway Board proposes to extend the use of motor vehicles on the State Railways during the next three years. For the broad-gauge lines ten new locomotives, four Diesel coaches and an electric coach will be acquired, and for the narrow-gauge three locomotives, four Diesel-electric coaches, four rail-motor buses and two electric locomotives.

France.—PARIS-LE MANS ROLLING STOCK.—In addition to 4,000-h.p. express locomotives, the French State Railways intend to employ lightweight high-speed motor coaches to maintain a fast direct service over the Paris-Le Mans line now being electrified. These streamlined cars will have a maximum speed of 93 m.p.h., and will cover the 131 miles at an average of about 65 m.p.h.

South Shields.—TROLLEY-BUSES.—Royal Assent has been given to the Bill empowering the Town Council to introduce trolley-buses into the borough, and it is anticipated that consideration will be given soon to the details of the scheme. It is understood that one of the first areas to be served will be along the Coast Road to Marsden.

South Africa.—NEW COACHES.—The South African Railways are to purchase seventy-two new coaches for use on the Rand system which is now being electrified. The contracts have not yet been placed. The coaches will be 69 ft. long and 9 ft. 1 in. wide, and a number of old coaches will be adapted for use on the electrified lines. A total length of 78 route-miles, or about 200 single-track-miles, is included in the electrification scheme, which will take two or three years to complete.

Sunderland.—ANNUAL REPORT.—The annual report of the Corporation transport undertaking for the year ended March 31st shows a revenue from the trams of £128,778 and working expenses of £86,606. The appropriation account for the two services amounted to £40,150, of which £9,000 was required as a contribution to the rates of the borough. Mr. C. A. Hopkins, the general manager, calls attention to the repeated raids on the transport undertaking reserves for contributions in relief of rates.

Communications

France.—TELEVISION.—According to *The Times*, M. Mandel, Minister of Posts and Telegraphs, has decided to extend the French television broadcasts, which have been carried on experimentally for some time, and to set up a 10-kW special transmitter at the top of the Eiffel Tower. This transmitter will broadcast on a wavelength of 7 metres on a 180-line screen, which is expected to yield good results in the Paris area. As it will take about six months before the new station can be completed, it has been decided to set up a provisional station, which will begin the sending out of transmissions on November 10th.

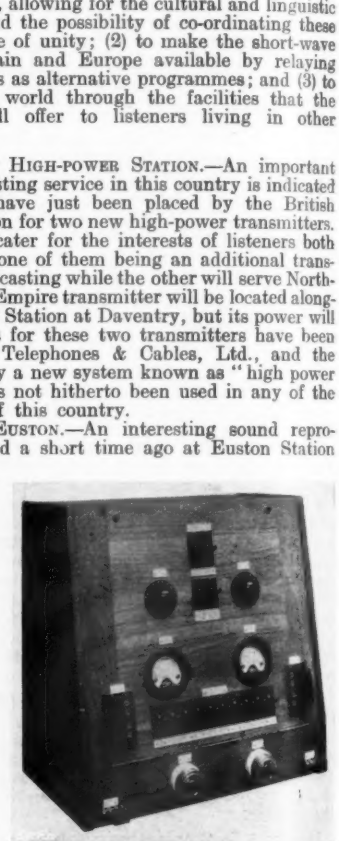
NEW TRANSMITTERS.—The new state controlled station of Toulouse-Muret will be inaugurated on October 5th. The State transmitter at Nice, which will eventually work on 60 kW, has begun test transmissions.

Germany.—BROADCASTING.—The Leipzig station's new aerial is likely to be completed by the end of this month when the station will resume broadcasting on 120 kW. The Heilsberg transmitter, which, owing to work in connection with the provision of a new anti-fading aerial, has been working on 17 kW, is now operating on a power of 100 kW and using the new aerial.

India.—BROADCASTING.—Our Bombay Correspondent reports that the chief broadcasting problems before Mr. Lionel Fielden of the B.B.C., who has been appointed the first Controller of Indian Broadcasting, will be:—(1) to establish services in the vernacular for all India, allowing for the cultural and linguistic claims of each area, and the possibility of co-ordinating these into the general scheme of unity; (2) to make the short-wave services of Great Britain and Europe available by relaying these to Indian listeners as alternative programmes; and (3) to interpret India to the world through the facilities that the short-wave system will offer to listeners living in other countries.

Great Britain.—NEW HIGH-POWER STATION.—An important addition to the broadcasting service in this country is indicated by the orders which have just been placed by the British Broadcasting Corporation for two new high-power transmitters. The new stations will cater for the interests of listeners both at home and overseas, one of them being an additional transmitter for Empire broadcasting while the other will serve North-Eastern England. The Empire transmitter will be located alongside the present Empire Station at Daventry, but its power will be greater. The orders for these two transmitters have been placed with Standard Telephones & Cables, Ltd., and the transmitters will employ a new system known as "high power modulation," which has not hitherto been used in any of the broadcasting stations of this country.

LOUD SPEAKERS AT EUSTON.—An interesting sound reproducing scheme, installed a short time ago at Euston Station by the General Electric Co., Ltd., has proved very successful. Over thirty loud speaker points were chosen to give complete acoustic cover to every part of the station where the train announcements should be heard. The main amplifier itself is housed in a specially constructed "announcing room" and the equipment consists of two complete 90-W amplifying channels with two microphones. Provision is made for two announcers to work simultaneously, each controlling any required number of the loud-speaker points, or either announcer can take complete charge of the whole system. The amplifiers employ two DA.100 "Osram" valves in low-loading push-pull for each channel. Moving coil microphones of a new pattern are used by the announcers, and some idea of the flexible control which has to be provided for these announcers can be gathered from the illustration, which shows the control board.



The control board for the amplifying installation at Euston

NEW RADIO STATION.—A new wireless station, providing a radio-communication and direction-finding service available to all aircraft, was brought into operation at Bristol on Monday.

ISLAY TELEPHONE SERVICE.—A new trunk service between Islay and the mainland has been inaugurated. The submarine telephone cable is 17 miles long and on the island itself there are 200 miles of telephone wire and 300 poles. For all calls between Islay and the mainland a fee of 6d. to meet the cost of providing the cable and its maintenance is charged in addition to the ordinary trunk charge.

Northern Ireland.—BELFAST TELEPHONES.—Our Irish Correspondent reports that the official date for the transfer of the telephone system in Belfast to automatic operation has been fixed for November 5th.

Contract Information

When "Contracts Open" are advertised in our "Official Notice" pages the date of the "Electrical Review" containing the advertisement is given in parentheses below

Contracts Open

Aldershot.—September 30th. Corporation. Lighting installation. (September 13th.)

Education Committee. September 30th. Electric lighting at Park Schools. Borough surveyor.

Argentina.—BUENOS AIRES.—October 15th. State Railways. Forty-eight splash-proof electric motors and twenty-six d.p. automatic switches. (T.Y. 10113.)*

October 14th. Argentine State Oilfields. Two single cylinder double-acting motor pumping sets. (T.Y. 5295.)*

Australia.—MELBOURNE.—Posts and Telegraphs Department. October 8th. Telephone switchboard parts and accessories. (T.Y. 10090.)* Telephone indicators of the drop, eyeball and ringing types (T.Y. 1008)* and various telephone dial parts. (T.Y. 10091.)*

October 15th. Testing instruments (voltmeters, ammeters, milliameters, &c.). (T.Y. 10092.)*

October 15th. Voice frequency telephone repeaters and associated ringing equipment. (T.Y. 10089.)*

October 15th. 1,520 yd. lead and antimony covered submarine cable. (T.Y. 10114.)*

October 22nd. Terminal and/or intermediate v.f. (1,000 cycles) ringers. (T.Y. 10093.)*

October 7th. City Council. 200 time switches. (T.Y. 10084.)*

Birmingham.—October 2nd. Electric Supply Department. E.h.v. cable. (September 7th.)

October 16th. Cookers for twelve months. (See this issue.)

Bradford.—October 7th. Electrical work at extension of Menston Isolation Hospital. Messrs. W. J. Morley & Son (architects).

Bromley (KENT).—October 7th. Electricity Department. Street-lighting standards. (See this issue.)

Burton-on-Trent.—October 18th. Electricity Department. Electric heating apparatus. (September 13th.)

Canada.—TORONTO.—October 1st. Department of Works. One 500-h.p. 2,300-V three-phase synchronous motor. (T.Y. 10077.)*

Carlisle.—October 21st. Electricity Department. Transformers. (See this issue.)

Dover.—October 7th. Corporation. Transformer chambers. (September 13th.)

Ealing.—October 8th. Electricity Department. Mercury-vapour street-lighting units, complete with standards. (See this issue.)

Egypt.—CAIRO.—October 7th. Department of Public Health. X-ray apparatus. (T.Y. 10063.)*

GIZA.—October 8th. Ministry of Education. Radio-telephone transmitting set, television equipment and radio components. (T.Y. 10064.)*

October 19th. Mechanical and Electrical Department, Ministry of Public Works. Supply and erection of electrically driven pumping set for Arish Barracks. (T.Y. 5290.)*

Folkestone.—October 5th. Town Council. Wiring thirty-two houses on the Hill Road estate. (See this issue.)

Gloucester.—Electricity Department. Meters and paper insulated cable. (See this issue.)

Ilford.—October 4th. Electricity Department. Three 500-kVA transformers with tap-changing equipment. (See this issue.)

India.—SIMLA.—October 22nd. Stores Department. D.c. and a.c. electricity meters as required during the period January 1st, 1936, to December 31st, 1936. (T.Y. 10083.)*

NEW DELHI.—December 5th. Stores Department. A.c. ceiling fans. (T.Y. 10111.)* December 12th. D.c. ceiling fans. (T.Y. 10109.)* January 9th. A.c. and d.c table fans. (T.Y. 10110.)*

October 15th. India Store Department. 66-kV overhead transmission lines for Malakand hydro-electric scheme. (September 13th.)

October 14th. Bombay, Baroda and Central India Railway Co. Insulators and insulator fittings, line fittings and switches. (See this issue.)

Irish Free State.—DUBLIN.—October 25th. Electricity Supply Board. 25,000-kVA, 5/38-kV transformer. (September 20th.)

Leyton.—October 7th. Electricity Department. Cable. (September 20th.)

Liverpool.—October 7th. Corporation. Tramcar trucks, electrical equipment, &c. (See this issue.)

Manchester.—October 11th. Electricity Committee. Chlorination plant for circulating water. (See this issue.)

Midlothian and Peebles.—District Asylum, Rosslynlee. September 28th. Electrical fittings. L. Addison-Smith, 19, Heriot Row, Edinburgh.

Morecambe and Heysham.—October 2nd. Public Lighting Department. Steel poles, centre suspension units, lanterns, &c. (September 20th.)

Newcastle-on-Tyne.—City Council. Installation of electric lighting in 400 houses. R. G. Roberts, architect, 18, Cloth Market, Newcastle.

New Zealand.—CHRISTCHURCH.—October 15th. Municipal Electricity Department. Twelve 200-kVA single-phase, oil-immersed indoor type transformers. (T.Y. 10095.)*

INVERCARGILL.—November 4th. City Council. Supply of 660 V and 11,000 V paper-insulated lead-covered, steel tape armoured cables. (T.Y. 10100.)*

November 4th. Tramways and Electricity Department. One single-panel h.v. cubicle and one 6-unit l.v. ironclad switchboard. (T.Y. 10012.)*

WELLINGTON.—October 17th. Post and Telegraph Department. Battery plates. (T.Y. 10066.)*

October 29th. Secondary cells and accessories. (T.Y. 10068.)*

October 30th. Telephone relay and condenser strips. (T.Y. 10069.)*

November 12th. Secondary cells. (T.Y. 10070.)* Telephone transformers, dials, plungers and telephones. (T.Y. 10101.)*

November 25th. Posts and Telegraph Department. Ammeters, voltmeters and high- and low-voltage relays. (T.Y. 10127.)*

January 14th, 1936. Public Works Department. Three 1,667-kVA oil-immersed, self-cooled outdoor single-phase transformers. (T.Y. 10060.)* Totally enclosed switchgear comprising o.c.b. control switches, operation indicators, &c., in connection with the installation of indoor switchgear at the Henderson sub-station.

AUCKLAND.—October 14th. 250 three-plate electric cooking ranges and, alternatively, 500 three-plate cooking ranges. (T.Y. 10122.)*

DUNEDIN.—December 9th. City Corporation. One 7,500-kVA, 6,600-V, three-phase, 50-cycle, totally enclosed, self-ventilating synchronous condenser. (T.Y. 10124.)*

Norwich.—Electricity Department. Street-lighting lanterns, brackets and standards. (See this issue.)

Oswestry.—September 30th. Electricity Department. E.h.v. transmission line and cable. (September 20th.)

Pontardawe.—September 30th. Electricity Department. 200-kVA transformer and kiosk. (September 20th.)

Rothesay.—Town Council. Electrical work at an indoor swimming pool.—R. D. Whyte, Council Chambers.

St. Andrews.—September 30th. Town Council. Electrical work at Muttoes Lane housing estate. Walker and Pride. Church Square, St. Andrews (deposit £1 1s.).

Salford.—October 2nd. City Council. Power transformers. (September 20th.)

Sheffield.—Electricity Department. October 11th. Five 450-kVA three-phase outdoor transformers. (See this issue.)

South Africa.—CAPE TOWN.—October 2nd. Electricity Supply Commission. H.v. cable and underground cable joint boxes. (T.Y. 10061.)* Three oil-immersed 300-kVA three-phase transformers. (T.Y. 10060.)* Totally enclosed switchgear comprising three complete switchboards. (T.Y. 10057.)*

PRIESKA.—October 9th. Municipality. Electrical generating plant switchgear, distribution and consumers' equipment. (T.Y. 10067.)*

Swansea.—October 18th. Electricity Department. Interior and exterior lighting installations, heating circuits, &c., at Tir John power station. (See this issue.)

Trimdon (Co. DURHAM).—Extension of the electric street-lighting system at Trimdon Colliery. J. G. Fenney, clerk, Roper's Terrace, Trimdon Grange.

Uruguay.—MONTEVIDEO.—October 18th. State Electricity Supply and Telephone Administration. Fifty-eight oil-immersed static transformers. (T.Y. 10059.)*

November 4th. 300,000 metres of paper and compound insulated cotton covered and braided Hackethal type wire and cable. (T.Y. 10103.)*

West Lancashire.—October 7th. R.D.C. (A) Two sets of electrically operated automatic sewage pumping plants. (B) Two sets of electrically operated automatic screening plants. (C) Circular sprinkling filters, valves, penstocks, &c., required for the Sefton area drainage scheme. H. B. Ward, consulting engineer, 26, North John Street, Liverpool (deposit £5 5s. in each case).

Willesden.—October 9th. Middlesex County Council. Electric lighting, power, ward and staff signalling installations in two ward blocks, Central Middlesex County Hospital. (September 20th.)

Wolverhampton.—Council. Sub-station, Stockwell End. Tettenhall. T. A. G. Margary, Council House.

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* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, London, S.W.1.

Contracts Closed

Carlisle.—City Council. Accepted. Electric wiring of 118 houses, Currock Estate, and 96 on Raffles Newtown Estate.—Hall and Stinson, Sheffield.

Dunfermline.—Town Council. Accepted. Electrical work at maternity home and hospital.—James Scott & Co., Dunfermline.

Grimsby.—Cleansing Committee. Accepted. Electric vehicle battery (£154).—Chloride Electrical Storage Co., Ltd.

Hastings.—Electricity Committee. Accepted. Switch and transformer kiosk (£223).—Crompton Parkinson, Ltd.

Leeds.—Electricity Committee. Recommended. Two boilers for Kirkstall power station (£169,350).—International Combustion, Ltd.

Lochgelly.—Town Council. Accepted. Electrical work at the Town Hall extension.—Peter & Ellis, Lochgelly.

London.—ISLINGTON.—Works Committee. Accepted. Traffic signals at three road junctions (£2,555).—Automatic Electric Co., Ltd.

STOKE NEWINGTON.—Electricity Committee. Accepted. Low-voltage cable.—Metropolitan Electric Cable and Construction Co., Ltd. 50 d.c. prepayment meters.—Measurement, Ltd. Two transformer kiosks.—Crompton Parkinson & Co., Ltd.

Storage battery.—Pritchett & Gold and E.P.S. Company, Ltd.

HAMMERSMITH.—Electricity Committee. Recommended. Twelve single-phase, air-cooled transformers (£1,829).—British Electric Transformer Co., Ltd.

Portland.—Electricity Committee. Accepted. Lighting control system (£111).—Automatic Electric Co., Ltd. Street-lighting equipment.—Revo Electric Co. and Electric Street Lighting Co.

Renfrew.—Town Council. Accepted. Electrical work at eighty-six houses at Porterfield.—Reid & Carrick, Renfrew.

South Africa.—**CAPE TOWN.**—Electricity Committee. Accepted. Erection of a sub-station at Wynberg (£2,150).—T. Moos. Test room battery (£107).—Siemens (S.A.), Ltd. Fibre conduits (£231).—Davis & Soper, Ltd. Cable boards (£632).—Mitchell Cotts & Co., Ltd.

Southampton.—Town Council. Accepted. 17,365 yards of cable (£21,086 to £21,191).—Pirelli-General Cable Works, Ltd. The lowest tender, recommended by the Electricity Committee, was that of W. T. Henley's Telegraph Works Co., Ltd., which was £104 lower. The higher one was accepted because the Pirelli-General Co. has local works.

Southend-on-Sea.—Town Council. Accepted. Electrical fittings for 364 houses on the Sutton Road estate at £272.—A. Harrison. 11,000-V transformers and switchgear for two years (£4,046).—General Electric Co., Ltd. 3,300-V transformers (£511 each).—Crompton Parkinson, Ltd.

South Shields.—Education Committee. Accepted. Electrical work (£650), High School for Boys.—Law & Burns, South Shields.

Forthcoming Events

Salford Technical and Engineering Association.—Saturday, September 28th. Royal Technical College, Salford. 7 p.m. "The British Grid Scheme—from Power Plant to Purchaser." Messrs. D. S. McGregor and R. H. Morris.

Electrical Association for Women (*London Branch*).—Thursday, October 3rd. 20, Regent Street, S.W.1. 2.30 p.m. "The Problems of the Builder in the All-Electric House." Mr. E. Vane.

Electrical Power Engineers' Association (*Southern Division*).—Saturday, October 5th. Annual dinner.

Notes

The E.A.W. House

The all-electric house which is being erected by the Electrical Association for Women at Bristol is now nearly completed and the opening ceremony will be performed on October 23rd by Catherine Countess of Westmorland.

Large Electric Clocks

Two new electrically operated bracket clocks, which must be amongst the most ambitious to be erected in the provinces, have recently made their appearance on the premises of the Northern Goldsmiths' Company, of Newcastle-on-Tyne.

These are of special design, the main frameworks surrounding the dials being cast in bronze, and surmounted by a symbolical figure. They are somewhat unusual for bracket clocks, for the frames are made in such a form that four dials can be fitted in place of the usual two or three. The reason for this lies in the sites chosen for the clocks, the situations permitting of visibility over a long distance, and from a wide angle.

One of the Northern Goldsmiths' clocks

The complete brackets are of unusual size, for each has an overall height of 14 ft. 6 in., and weighs 1¼ tons. It was therefore necessary to give special attention to the supporting fixings, and an arrangement of cantilevered steelwork is built into the building in each case. Each bracket has four dials over 3 ft. in diameter, and the mechanism for operating these is in each case a half-minute impulse master clock, with a seconds pendulum of invar. Each dial is provided with a step-by-step movement actuated by the master clock impulses, this mechanism being of a specially sturdy type to resist the weather conditions to which it is subjected. At the same time it is small enough to avoid casting any shadow on the opal glass of the dial when illuminated at night. The hands are carefully poised and have been stiffened to resist wind pressure.

The master clocks of these installations are operated from batteries and are located inside the buildings, thus giving simplicity and easy maintenance. The clocks were designed by the architects, Messrs. Cackett, Burns, Dick & Mackellar, and the clockwork portion of the installation was constructed by the Synchronome Co., whilst the Tudor Art Metal Co. (1935), Ltd., was responsible for the cases and figures. The latter were from a model by Mr. Arthur Glover, the well-known sculptor.

The I.E.E. 1935-36 Session

The Institution of Electrical Engineers has issued its programme for the ensuing session. The president, Mr. J. M. Kennedy, will deliver his inaugural address on October 24th and the arrangements for subsequent meetings are as follows: November 7th, "Equipment and Performance of Steel-tank Rectifier Sub-stations operating on the Underground Railways of the London Passenger Transport Board," by Mr. A. L. Lunn; November 21st, "Standardisation of Impulse-voltage Testing," by Dr. T. E. Allibone and Mr. F. R. Perry; December 5th, "Modern Developments in Railway Signalling," by Major L. H. Peter; December 19th, "A Cathode-ray Oscillograph with High-speed Drum Camera rotating *in vacuo*," by Mr. G. A. Whipple; January 2nd, "Applications of the Hot-cathode Grid-controlled Rectifier, or Thyratron," by Mr. A. L. Whiteley; January 16th, "Recent Developments in Long-distance Telephony," by Mr. A. C. Timmis; January 30th, subject to be announced later; February 13th, annual dinner; February 20th, March 5th and 19th, April 2nd, subjects to be announced later; April 23rd, twenty-seventh Kelvin Lecture by Mr. J. D. Cockcroft.

Electrical Pile-driving Plant

An unusual application of electrical drive, but one which is proving distinctly economical, is being exploited by the Middle Level Drainage and Navigation. The photographs on page 425, for which we are indebted to Mr. R. G. Clark, M.Inst.C.E., chief engineer, show the electrical pile-driving plant used on the banks of the Sixteen Foot River, near Stonsea Station. It was constructed at the Middle Level Stores, March, and consists of a frame accommodating a 2-ton hammer, a Woodfield friction winch, and a 220-V motor, the generating plant (a Daimler motor engine directly coupled to a dynamo) being carried on a barge floating on the river. As a friction drive the plant is able to put in from 20 to 25 blows a minute. Not only is the electrical drive more economical, but a good deal of time is saved in handling and shifting the plant owing to the motive machinery being carried on the barge.

Fatalities

A verdict of "Misadventure" was recorded at an inquest at Accrington on September 18th into the death of Robert Wyper, aged fourteen, of Airdrie, who died following an electric shock received while using a hair-dryer. In the evidence it was stated that an earth wire had been connected with one of the current-carrying plugs in error, and that there was a fault in the hair-dryer.

The *Manchester Guardian* reports that at an inquest held on B. Powell, a foreman labourer, Ashton, it was stated that the deceased man was fixing new air grids under the floor of a house when he received a fatal electric shock. Messrs. A. H. Fay and A. E. Jones, of the Manchester Corporation Electricity Department, said that upon investigation they found a cable was frayed where it entered some conduit and when the latter was moved the bare wire made contact with it. At the same time they found that the earth wire had been broken away from the earthing clip on a water pipe, apparently by Powell himself. A verdict of "Accidental Death" was returned.

Appointments Vacant

Deputy electrical engineer and assistant mains engineer for Chester Electricity Department.

Sales and commercial assistant for Welwyn Garden City Electricity Supply Co., Ltd.

Temporary examiners in the w/t section of the Aeronautical Inspection Directorate for the Air Ministry.

Technical assistant (Class J. Grade 5) and assistant chemist (Class J, Grade 9a) for Sheffield Electricity Department.

Steam engineers and junior control engineers for the County of London Electric Supply Co., Ltd.

Shift charge engineers at the Mogden purification works, Isleworth, for the Middlesex C.C.

Showroom attendant and clerical assistant for Skipton Electricity Department.

Assistant power station superintendent and meter repairer for Norwich Electricity Department.

Sales assistant for Alderley Edge and Wilmslow Electricity Board.

(See our classified advertisements.)

Makers' Names Wanted

"**THEXOR**" electric iron.

"**HOCKING**" water heater.

"**AUTUMN**" fancy shades and lighting fittings.

British machine for the manufacture of tight, even and closely-wound double-cotton covered and impregnated wire for armatures, capable of withstanding rubbing, tension in wire and pressure on coils during winding.

Our Personal Column

Electrical men are invited to keep readers of the "Electrical Review" posted concerning their movements

Captain J. T. Keeping, general secretary of the Electrical Industries Benevolent Association, is leaving that position on September 30th, after seven and a half years with the organisation. He relinquishes a work which, as is well known, has involved a vast amount of detail connected with the more human side of the electrical industry, and he does so with the cordial good wishes of the Executive Committee, who hope that he will continue to find a place for the exercise of his activities electrically.

Mr. F. S. Naylor, the author of the article on "Diversity Factor," which appears on page 405 of this issue, is technical assistant with the West Midlands Joint Electricity Authority. He is an associate member of the Institution of Electrical Engineers, an associate of the City and Guilds of London Institute, and holds the London B.Sc. degree.

Mr. F. S. Naylor

Mr. L. J. N. Kirkby, who has been assistant electrical engineer to the Chester Corporation since 1927, is leaving to take up a position with the Admiralty, and has received presentations from the staff of the Corporation Electricity Department. For two years Mr. Kirkby was junior assistant mains engineer with Callender's Cable & Construction Co., Ltd., on its contract staff to the Birmingham Corporation Electric Supply Department. Since 1930 he has been responsible whilst at Chester for the change-over from d.c. to a.c.

Mr. L. P. Lockwood, A.M.I.E.E., of Oldham, was married on September 14th to Miss Dorothy Hobson.

The Marchese Marconi has been appointed to the new chair of electro-magnetic waves at the Rome University. A *Reuter* message from Rome states that he is at present in Brazil and is returning to Europe next month.

Mr. E. Branfield, who has been with the Cardiff Corporation Electricity Department for over thirty years, has retired, and on Saturday last Mr. O. S. Hosgood presented him with an inscribed oak clock on behalf of his colleagues.

Mr. E. D. Davies

Mr. E. D. Davies, whose article on "Electric Ploughing" appears on page 399, graduated at Cardiff University College and became a trainee and later assistant distribution engineer with the South Wales Electrical Power Distribution Co. Subsequently he was appointed technical assistant and technical officer in the Air Ministry, leaving that position to become engineer-in-charge of contracts with Messrs. Siemens Bros. & Co., Ltd. He at present holds the appointment of section engineer for the South Wales District under the Central Electricity Board, South West England and South Wales Scheme.

Mr. S. F. Blaxland, of the Dover Corporation electricity works staff, was recently married to Miss M. D. Prince.

Mr. F. Riding, electrical engineer and contractor, was married on September 12th to Miss Letitia Fielden, who was formerly employed in the Blackburn Corporation electricity showrooms.

Mr. H. H. Denton, who has been engineer and manager of the Crewe Corporation Electricity Department from its inception in 1900, is retiring next week. He is succeeded by Mr. A. D. Hegan, details of whose career appeared in the ELECTRICAL REVIEW of September 13th.

Mr. L. Wilson has retired from the position of chief inspector in the Post Office Engineering Department at Rochdale. He has been in the Post Office service for forty-six years.

In recognition of services rendered in connection with the construction of the Moscow Underground Railway the Russian Decoration of Merit was conferred at the Soviet Embassy last Friday on the following officials of the London Passenger Transport Board: **Lord Ashfield** (chairman), **Mr. Frank Pick** (vice-chairman), **Mr. A. R. Cooper** (chief engineer), **Mr. E. T. Brook** (superintendent of railway rolling stock), **Mr. Evan Evans** (general railways superintendent), and **Mr. J. C. Martin** (new works assistant). A similar decoration was presented to **Mr. David Anderson,** consulting engineer.

Mr. Lachlan Mackinnon, general manager of the Glasgow Corporation Transport Department, is to retire in March next year. He has taken a prominent part in developing the Glasgow undertaking, with which he has been associated since the tramways were transferred from private ownership to the Corporation in 1894. He was actually the first member of the tramways staff, being chosen as private clerk to Mr. John Young, the first general manager of the Tramways Department, who was engaged in the preliminary work which preceded Corporation control. In 1902 Mr. Mackinnon became traffic manager, which position he held until 1910, when he was appointed deputy to the then general manager, Mr. James Dalrymple, who succeeded Mr. Young in 1904. His abilities were recognised in his appointment as general manager in 1927, when Mr. Dalrymple retired. Many important developments in the Glasgow transport system have been witnessed by Mr. Mackinnon during his long service. The first notable change with which he was identified was the electrification of the horse-drawn trams. Another important enterprise during his general managership has been the electrification of the Subway.

Mr. L. Mackinnon

Ald. John R. Potts, J.P., has been elected Mayor of Carlisle during the ensuing year. Mr. Potts has served on the Carlisle City Council for many years, and he is a member of a number of committees, including the Electricity Committee, of which he is the chairman. Additionally, he was Traffic Commissioner under the 1931 Road Act, whilst for fourteen years he has served as a member of the Carlisle and District State Management Scheme. He is the district manager of Messrs. H. J. Baldwin & Co., cable protection specialists, in Scotland and Northern England.

[*F. W. Tassell*

Alderman J. R. Potts, J.P.

Mr. A. C. Whitcher, second son of Mr. J. Whitcher, M.I.E.E., was married on September 20th to Miss R. K. Linton Smith, daughter of the Bishop of Rochester. Mr. Whitcher is in the Indian Imperial Customs Service.

Mr. E. W. Porter, electrical engineer for the Derby district of the London, Midland & Scottish Railway, has retired, and has been presented by his colleagues with a silver teapot and tray.

Mr. James Crewdson, a member of the staff of Blackburn Electricity Department, was married recently at St. Silas's Church, Blackburn, to Miss Hilda J. Curd. The presents included a chromium fire suite from the bridegroom's colleagues.

Mr. M. W. Singer, M.Sc. Tech., A.M.I.E.E., informs us that he has moved to 37, Portman Road, King's Heath, Birmingham, 14. (Telephone: Highbury 1250.)

The Southend-on-Sea Town Council has granted honorariums of £75 to **Mr. J. Linton,** chief assistant electrical engineer, and £25 to **Mr. L. H. Woods,** chief mains draughtsman, for services in connection with the town illuminations which were described in our issue of August 23rd.

Mr. J. H. M. Wakefield, who entered the Post Office service in Leeds in 1890, and later held posts in the Engineering Department in Croydon, Guildford, Hereford, Hull, London and Newport (Mon.) is retiring from the service at the end of this month.

Mr. J. H. M. Wakefield

In the early 'nineties Mr. Wakefield was employed in the Superintending Engineer's office in Leeds—he finishes his career as second in command, Engineering Department, Croydon, in the South-Eastern District, which controls the Brighton, Canterbury and Tunbridge Wells areas. During his service in Newport he laid a cable over the railway bridge which spans the Severn at Sharpness (Glos), ran a cable through the Severn Tunnel, and arranged for the landing of a cable which was laid in the bed of the river. Whilst at Croydon in recent years he was closely associated with the landing of more than one cable laid in the English Channel. Over twenty years ago he installed automatic exchanges at Newport and Chepstow (Mon.). He entered the I.E.E. as an associate in 1899 and has been an associate member since 1912.

Obituary

Mr. Thomas Percival Pask, formerly chief electrical engineer of the South African Railways and Harbours, has died at Mossel Bay, Cape Province, where he had lived since his retirement a few years ago. Mr. Pask was born at Bury St. Edmund's in 1873. He went to South Africa in 1895 and joined the Cape Government Railways, later taking an appointment with the Natal Government Railways, and joining the national administration at the time of the Union in 1910.

Mr. H. Cox.—The death occurred on September 17th, at the age of thirty-two, of Mr. Harry Cox, manager of the Esher & Claygate Electric Installations, Ltd. He had been engaged in the business for seventeen years, and had been manager for about six years.

Mr. R. S. McLeod.—The death occurred on September 22nd at his home at Bromley (Kent), of Mr. Robert Stafford McLeod, M.I.E.E., formerly engineer and director of the Lancashire Dynamo & Crypto, Ltd.

Mr. H. J. Muston.—The death is announced, following an operation, of Mr. Hubert Joseph Muston, who was head of the tool-room drawing office at the works of the British Thomson-Houston Co., Ltd., Rugby. He had been with the company for thirty-three years, and was fifty years of age.

Financial Section

New Companies, Returns of Share Capital, Debenture Charges, Reports of Electrical Companies, Dividend Changes, Transactions in Stocks and Shares

New Companies Registered

Aspden Television Corporation, Ltd.—Private company. Registered September 19th. Capital, £10,000 in 6,500 7 per cent. non-cumulative preference shares of £1 each and 70,000 ordinary shares of 1s. each. Objects: To adopt an agreement with Ralph L. Aspden, and to carry on the business of manufacturers, exporters and importers of, agents for, and dealers in, all kinds of television and stereoscopic television apparatus and components and all kinds of wireless, electrical, telegraphic, photographic and scientific apparatus, &c. The directors are: R. L. Aspden, Television Laboratories, Shaw Hill, Chorley, Lancs, and two others.

British Acoustic Industries, Ltd.—Private company. Registered September 20th. Capital, £250 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in radio, electrical and cinematograph apparatus, accessories and spares, &c. The directors are: L. Eastwood, 10, Long Street, E.2, and two others. Registered office: Lloyds Bank Chambers, 44/47, Aldersgate Street, E.C.1.

E. G. Kellond, Ltd.—Private company. Registered September 20th. Capital, £1,500 in 1,200 redeemable preference shares of £1 each, 500 "A" ordinary shares of 2s. and 250 "B" ordinary shares of £1 each. Objects: To acquire the business of an electrical engineer and contractor carried on by Ernest G. S. Kellond at 3, New College Parade, Finchley Road, N.W. The subscribers are: S. Goss, 75, Fairfax Road, N.W.6, and C. S. Green, 1, Grosvenor Road, Northwood. S. Goss signs as director. Registered office: 3, New College Parade, Finchley Road, N.W.3.

Douglas Holt (Established 1919), Ltd.—Private company. Registered September 21st. Capital, £1,000 in £1 shares. Objects: To acquire the business heretofore carried on by Douglas Holt at 9, Little Turnstile, W.C., and to carry on the business of manufacturers and repairers of, agents for and dealers in motor car lamps, electric bulbs, wireless transmitting and receiving sets, &c. The first directors are: D. Holt (permanent managing director), and Mrs. V. B. A. Holt, both of 131, Station Road, Hendon, N.W.4.

Photo Electrograph, Ltd.—Private company. Registered September 12th. Capital, £100 in 1s. shares. Objects: To acquire from J. P. Frater of 20, Penwerris Avenue, Osterley, the whole of the rights in provisional patent No. 19081/35 of the machine known as "Photo Electrograph," to acquire any improvements relating thereto, and to carry on the business of commercial photographers, &c. The first director is: A. Archibald, Berkeley, Park Road, New Barnet. Registered office: 10, Cork Street, Old Bond Street, W.1.

Harmaur Radio Co., Ltd.—Private company. Registered September 14th. Capital, £100 in £1 shares. Objects: To carry on the business of manufacturers of, agents for and dealers in radio, magnetic, galvanic and electrical goods and appliances, &c. The directors are: R. J. Adams, 95, Westbury Avenue, Southall, Middlesex, and M. Essex, 60, Clifton Court, Maida Vale, W.9. Secretary: M. Essex, Registered office: 8, Clifford Street, Bond Street, W.1.

Enfield Rentals, Ltd.—Private company. Registered September 18th. Capital, £100 in £1 shares. Objects: To carry on the business of makers and letters on hire of apparatus for the reception of sound or vision, &c. The subscribers are: C. T. F. W. Dobson, 19, Drapers Road, Enfield, and H. C. Ball, 48, Parsonage Lane, Enfield. Solicitors: Morris, Ward-Jones, Kennett & Co., 19/21, Moorgate, E.C.2.

Trianon Hairdressing Supplies, Ltd.—Private company. Registered September 18th. Capital, £150 in £5 shares. Objects: To carry on the business of dealers in and manufacturers of hairdressers' supplies and accessories, and electrical goods of all kinds, &c. The directors are: Dr. W. Schlochoff (permanent managing director), 82, Priory Road, N.W.6, and R. Neil, 10, Charnock Road, E.5. Registered office: 82, Priory Road, N.W.6.

Perfection Wireless (Liverpool), Ltd.—Private company. Registered September 12th. Capital, £1,000 in 600 ordinary and 400 6 per cent. preference shares of £1. Objects: To acquire the radio business now carried on by F. W. H. Bullock at 33, Moorfields, Liverpool, and to carry on the business of manufacturers of and dealers in wireless and television sets, &c. The first directors are: F. W. H. Bullock, 47, Orrell Lane, Liverpool, 9, and Mrs. M. Wheeler, 17, Woodhey Road, Rock Ferry.

Cadenza Radio, Ltd.—Private company. Registered September 18th. Capital, £500 in £1 shares. Objects: To carry on the business of dealers in and manufacturers of radio, gramophone and electrical goods of every description, gramophone records, amplifying apparatus, &c. The subscribers are: V. S. Burgess, 38, Froissart Road, Eltham, Kent, and R. Hay, 17, Lorrimore Street, S.E.17. Secretary: B. Phillips, 118-122, Great Portland Street, W.1.

Fourwave, Ltd.—Private company. Registered September 16th. Capital, £2,500 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in radio, television, electrical, scientific and telephone apparatus and installations, &c. The first directors are: H. E. Pearce, "Greentrees," Merstham, Surrey, and three others. Registered office: 92, Victoria Street, S.W.1.

Silvagrey Electric, Ltd.—With reference to the registration of this company, announced in our issue of September 13th, we are informed by the company that the registered office is at Harman Chambers, High Street, Dorking, and that Mr. C. F. Roe is secretary.

Returns of Electrical Companies

W. Saunders, Ltd.—Satisfaction in full on August 22nd of charge dated May 20th, 1920, and registered May 28th, 1920, securing £2,200.

Doncaster District Relay Services, Ltd.—The nominal capital has been increased by the addition of £4,000 beyond the registered capital of £1,000. The additional capital is divided in 4,000 ordinary shares of £1 each.

Radio Hire Service, Ltd.—Mortgage, dated September 10th, 1935, to secure £292 10s., charged on agreements for the hiring of wireless apparatus. Holders: Sussex Finance Corporation, Ltd., 85, South Street, Eastbourne.

Permaheat Safety Cushion Co., Ltd.—Particulars filed of £2,000 debentures, authorised July 15th, 1935, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £300.

Super Radio (Manchester), Ltd.—E. N. Lawler, of 53, Railway Road, Leigh, ceased to act as receiver on August 28th, 1935.

Reliance Trading Co. (Liverpool), Ltd.—Satisfaction in full on September 13th, 1935, of debenture dated July 22nd, 1927, and registered July 28th, 1927, securing £300.

Electrical Distribution of Yorkshire, Ltd.—Capital, £2,200,000 in £700,000 6 per cent. cumulative preference stock and £1,500,000 ordinary stock. Return dated March 19th, 1935. All stock taken up. £2,200,000 paid. Mortgages and charges, nil.

Weldrics (1922), Ltd.—Capital, £25,000 in £1 shares. Return dated March 19th, 1935. 16,000 shares taken up. £13,925 paid, £2,000 considered as paid, £75 calls unpaid. Mortgages and charges, nil.

Radiorite, Ltd. (formerly Excel Radio Units, Ltd.).—Capital, £500 in £1 shares. Return dated March 22nd, 1935. 301 shares taken up. £201 paid, £100 considered as paid. Mortgages and charges, nil.

Northern Telephone & Electrical Co., Ltd.—Capital, £500 in £1 shares. Return dated March 7th, 1935. 210 shares taken up. £210 paid. Mortgages and charges, nil.

Leamington & Warwick Electrical Co., Ltd.—Capital, £100,000 in 2,500 5 per cent. cumulative preference and 7,500 ordinary shares of £10 each. Return dated March 7th, 1935. All shares taken up. £100,000 paid. Mortgages and charges: £35,000.

Thames Valley Electric Supply Co., Ltd.—Capital, £150,000 in £1 shares. Return dated April 1st, 1935. 50,000 shares taken up. £50,000 paid. Mortgages and charges, nil.

Kolster Brandes, Ltd.—Capital, £1,290,000 in 4,300,000 shares of 6s. each. Return dated April 30th, 1935. 1,166,000 shares taken up. £124,800 paid, £225,000 considered as paid. Mortgages and charges, nil.

W. E. Dove & Co., Ltd.—Capital, £3,500 in £10 shares. Return dated April 26th, 1935. 320 shares taken up. £2,000 paid, £1,200 considered as paid. Mortgages and charges: £800.

S. Rogers & Co., Ltd.—Capital, £1,000 in £1 shares. Return dated March 20th, 1935. 660 shares taken up. £660 paid. Mortgages and charges, nil.

Wireless Electric (Wholesale), Ltd.—Capital, £5,400 in £1 shares (increased from £3,400 on August 1st, 1935). Return dated January 4th, 1935. 3,300 shares taken up. £1,020 paid, £2,280 considered as paid. Mortgages and charges: £2,000. A further 1,000 shares were allotted for cash on August 1st, 1935.

Clarke, Chapman & Co., Ltd.—Capital, £550,000 in 7,000 preference shares of £10 and 480,000 ordinary shares of £1. Return dated March 15th, 1935. 6,985 preference and 456,560 ordinary shares taken up. £100,210 paid (£10 per share on 4,435 preference, £1 per share on 55,360 ordinary, and 5s. per share on 2,000 ordinary shares), £426,200 considered as paid (£10 per share on 2,550 preference, £1 per share on 399,200 ordinary, and 15s. per share on 2,000 ordinary shares). Mortgages and charges, nil.

William Lawson, Ltd.—Capital, £1,000 in £1 shares. Return dated March 22nd, 1935. 670 shares taken up. £637 paid, £33 considered as paid. Mortgages and charges, nil.

Marconi Sounding Device Co., Ltd.—Capital, £75,000 in £1 shares. Return dated March 28th, 1935. All shares taken up. £75,000 paid. Mortgages and charges, nil.

F. O. & H. S. Hughes, Ltd.—Capital, £1,000 in 750 ordinary and 250 6 per cent. cumulative preference shares of £1. Return dated March 9th, 1935. 427 ordinary shares taken up. £427 paid. Mortgages and charges, nil.

Banbury & District Electric Supply Co., Ltd.—Capital, £75,000 in £10 shares. Return dated March 25th, 1935. All shares taken up. £50,000 paid, £25,000 considered as paid. Mortgages and charges, nil.

Isle of Thanet Electric Supply Co., Ltd.—Capital, £500,000 in 282,000 6 per cent. preference, 150,000 ordinary, and 68,000 unclassified shares of £1 each. Return dated March 28th, 1935. 282,000 preference and 150,000 ordinary shares taken up. £222,000 paid on 222,000 preference shares, £210,000 considered as paid on 150,000 ordinary and 60,000 preference shares. Mortgages and charges: £259,674.

Harrow Electric Light & Power Co., Ltd.—Capital, £50,000 in 3,333 preference and 6,667 ordinary shares of £5 each. Return dated March 26th, 1935. All shares taken up. £50,000 paid. Mortgages and charges: £25,000.

Chesham Electric Light & Power Co., Ltd.—Capital, £200,000 in £1 shares. Return dated March 12th, 1935. All shares taken up. £179,998 paid, £20,002 considered as paid. Mortgages and charges, nil.

Tubelamps, Ltd.—The nominal capital has been increased by the addition of £25,000 beyond the registered capital of £15,000. The additional capital is divided into 25,000 7 per cent. cumulative redeemable preference shares of £1 each.

Rushden & District Electric Supply Co., Ltd.—Satisfaction to the extent of £50,000 on July 1st, 1935, of debenture stock authorised March 12th, 1925.

E. F. Blakeley & Co. (Liverpool), Ltd.—Further charge on the company's property, present and future, including uncalled capital, dated September 3rd, 1935, to secure £1,300. Holder: W. Sutton, 5, Rolleston Drive, Wallasey, Ches.

Braintree Broadcast Relay Service, Ltd.—Mortgage on properties in Halstead, Essex, dated September 2nd, 1935, to secure all moneys due or to become due from the company to Lloyds Bank Ltd., not exceeding £300.

City Notes

Ferranti, Ltd., held their annual general meeting last Friday, Mr. V. Z. de Ferranti (chairman and managing director) presiding. Moving the adoption of the report and accounts (see our last issue, p. 391), the chairman stated that the turnover of the business showed a considerable increase, due mainly to larger sales of radio and domestic apparatus. The popularity of their radio receivers had been increasing so rapidly that it had become necessary either to build new works or find additional premises. Freehold works had been purchased at Moston, quite near to Hollinwood, and equipped with the most up-to-date machinery, and they now possessed a modern factory capable of producing their latest designs in large quantities. There were signs that the demand for the sets would exceed that for the previous year. The space vacated at Hollinwood had allowed them to increase their production of electric fires, water heaters and clocks, to meet the growing demand. While he did not expect television to be within the reach of the majority of the public for a number of years, they had taken steps to develop suitable apparatus to deal with the demand when it grew. The report and accounts were adopted unanimously, and the retiring director, Mr. R. W. Cooper, was re-elected.

The Southern Areas Electric Corporation, Ltd.—An extraordinary meeting was held on September 20th to consider the increase of the number of directors from seven to eleven and the appointment of four additional directors. There was a very large attendance, and after considerable discussion the resolution for the increase in the number of directors was put to the meeting and on a show of hands was rejected by a large majority. Subsequently a poll was demanded which resulted as follows: For the resolution, 85,623; against the resolution, 167,175. It having been intimated on behalf of the requisitionists that if the first resolution were not passed the other resolution would not be proposed, the meeting accordingly terminated on the declaration of the poll.

Companies to be Struck off the Register.—The names of the following companies will be struck off the Register at the expiration of three months from September 17th unless cause is shown to the contrary:—Anglo-Continental Lighting Co., Ltd.; Brighter London Signs, Ltd.; British Ipso Battery Co., Ltd.; Car-Radios, Ltd.; Co.-Radio, Ltd.; Cordo Electrical Products, Ltd.; Friar Radio Co., Ltd.; New North Radio, Ltd.; Rayfac Radio, Ltd.; and Ultramonic Co., Ltd.

The Sun Electrical Co., Ltd., reports trading profits for the year ended April 30th last of £23,575, an increase of £5,462 as compared with the preceding year, and a net profit of £20,092, as against £15,704. The ordinary dividend for the year is 6 per cent. (against 5 per cent.), reserve receives £2,000, and £1,500 is allowed for leasehold redemption. The amount carried forward is £4,131, against £4,012 brought in. Meeting: September 30th.

Singapore Traction Co., Ltd.—The shareholders have approved the creation of £250,000 of 5 per cent. convertible debenture stock; an agreement between the company and the Shanghai Electric Construction Co., Ltd.; the creation of 150,000 £1 ordinary shares; and the cancellation of special reversionary share rights. The directors were authorised to amend the articles of association to extinguish the rights of management possessed by the Shanghai Company.

Hopkinsons, Ltd., are resuming the payment of interim dividends, 2½ per cent., less tax, being payable on October 31st. The last interim dividend (of similar amount) was paid in 1933, but then there was no final distribution. For last year a dividend of 5 per cent. was paid.

The Midland Electric Corporation for Power Distribution, Ltd., has declared an interim dividend of 3 per cent., less tax, on the ordinary shares (unchanged).

J. & F. Stone Lighting & Radio, Ltd., is extending the last day for accepting registration forms for the recent preference share issue until next Monday, September 30th.

The Montreal Light, Heat & Power Consolidated is to pay a quarterly dividend of 37 cents (same) on its common shares on October 31st.

The West London & Provincial Electric & General Trust, Ltd., is to pay 2½ per cent., less tax, on the preference stock, and 1½ per cent., less tax, on the ordinary stock (same).

The Electrical Finance & Securities Co., Ltd., is maintaining its interim dividend at 5 per cent., less tax.

The Marconi International Marine Communication Co., Ltd., has announced an interim dividend of 2½ per cent., less tax.

Stocks and Shares

TUESDAY EVENING.

THE political situation takes precedence of every other factor in Stock Exchange markets. On one day, everything is flat: on the next a general recovery occurs, the movements being dictated by the varying character of the news. That there will be a Government borrowing on a fairly substantial scale for additional defence is practically assured. Rumours sported with the idea two or three days ago that a £200,000,000 Defence Loan was on the point of being offered. Rumour, indeed, plays a large part in the swaying of prices. However improbable or fantastic a report may appear, it gains ready hearing, and, to some extent, it influences prices. The quotations in our weekly list show a long string of falls, due, it is unnecessary to say, to the apprehensions aroused by the Italian-Abyssinian crisis. The mere fact of Mussolini having consented at last to open negotiations was taken in itself to be a sign of hopefulness. Nervousness is still very apparent, but it may be said that, at the moment, a cautiously hopeful view is entertained.

Revaluation?

It is tolerably safe to assume that one result of the present crisis will be a readjustment of investment's idea of values. Prices had reached very high levels; the yields on British Government stocks, and on securities of the first-class order, are still meagre. Shares in the leading industrial groups were standing at exalted figures. It looks as though the peak of prices may have been reached, and that, at any rate for a time, the disposition of capital will be to expect rather better returns than have been obtainable during the past few months. Against this view can be set the fact that a good deal of money recently realised by the sale of British Government stocks is now awaiting reinvestment. One of these days, it will be returning to Stock Exchange markets when confidence is restored and when political events at home and abroad more nearly approach what may be called the normal. It will be noticed that the prices of a number of shares in the list of Home electricity supply companies have receded further, following upon the falls that took place last week. The prices of to-day offer a reasonably satisfactory yield; should the League of Nations succeed in averting an open clash of arms, quite possibly the relief felt at such a happy ending to the dispute would bring about an upward reaction. Taking a longer view, however, the observer will be tempted to regard

to-day's range of yields and of prices as reasonable, so long as the expectation of British Government borrowing is left in suspense.

Gilt-edged Stocks

An issue, British Government guaranteed, of African Transport 2 per cent. stock at 98½, was left in the hands of underwriters to the extent of 91 per cent. London Electric Transport guaranteed stock is 2 down at 94. Central Electricity securities are heavy. The 3½ per cents of 1963-93 have fallen 2 to 102. London Passenger Transport " C," after its spurt, to 102 on dividend hopes, has returned to par.

Electricity Supply Shares

The unsparing way in which prices were lowered last Friday in the list of Home electricity supply shares suggested that the falls were to a large extent sympathetic with the rest of the markets rather than due to any particular pressure to realise their holdings on the part of shareholders. This impression was confirmed by the lively manner in which prices rallied on the Monday in this week, when the possibility of peace being maintained seemed to approach a little nearer by reason of the Italian dictator's change of attitude. It may be mentioned, as a matter of interest, that in a catalogue of electricity supply prices, furnished every day by a leading firm of Stock Exchange dealers, and comprising thirty different quotations, all but eight were marked down on Friday last. Three days later, recoveries were recorded against the majority of the prices that had given way. On balance, the changes are downward. Prices of ordinary shares in this group are now reaching a level at which the average return on the money comes to approximately 4 per cent. This in itself is a modest return, but seeing that it was only the other day that the same shares were paying barely 3½ guineas per cent., the readjustment of values has already made, it will be observed, some progress. Scottish Electric Power are ex rights, and the new shares are quoted at 6s. premium. Amongst the ordinary shares that have gone ex dividend this week are British Power & Light, Electric Supply Corporation, Hendon (52s.), Midland Electric Power, Midland Counties and Scottish. Deduction of the dividends had a stimulating effect, British Power & Light, for example, advancing from 28s. 6d. x.d. to nearly 1s. higher. The provincial group is reasonably steady. Of the overseas shares, Palestine A, which dipped to 46s., recovered to 47s., still showing a fall of a florin on the week. Victoria Falls ordinary at 3¼ have gone back ¼. Tokyo Electric sixes at 82½ are 10s. down.

Cable and Wireless

In the general malaise, Cable & Wireless preference stock fell to 94½. At the same time, the 7½ per cent. A ordinary fell to 21. In both cases there were modest recoveries, but the market in the stocks is still dull. The B stock has gone back to 6½. The monthly traffic return, although it showed a slight advance, caused a certain amount of disappointment. People had been hoping that the extra traffic stimulated by the present crisis would enable Cable & Wireless figures to make a really good showing, whereas the improvement was negligible. Globe Telegraph & Trust ordinary hardened, nevertheless, to 13.

American Telephone & Telegraph shed 3 points but regained 2 of them. Internationals are 10½. Anglo-American deferred has eased off to 27¼.

Manufacturing and Equipment

The market for stocks and shares in the group of manufacturing and equipment companies has been tolerably lucky in escaping marked falls in prices. Most of the shares have fallen to some extent, but there is no serious loss. Ericsson Telephones are 5s. down at 6⅞, and this is the largest decline that has occurred. British Aluminium ordinary at 41s. 6d. are 1s. lower. Falls have occurred in Aron Electricity, Associated Electrical Industries and Cromptons. English Electrics dropped to 15s., the preference to 20s. Enfield Rolling Mills have come on offer and are a dull market at 23s. 9d. General Electrics, after dipping below 60s., recovered to 61s. 3d. Amongst the ex dividend markings of the present week are British Insulated and International Automatic Telephone ordinary (39s.). A fall of 2 points in Brush at 47½ followed the offer of a few hundred pounds of stock. Telephone Rentals at 8s. 4½d. and Telephone Manufacturing at 7s. 3d. show trifling declines.

Miscellaneous Matters

British Electric Traction deferred parted from 75 points, but rallied again and at 1050 the fall is a mere 25 points. The 8 per cent. preferred ordinary at 170 is down 7½; stock changed hands as low as 165. London Associated Undertakings went back to 29s. 6d. before picking up to 32s. It is announced that a reduction in charges is to be made by two of the companies that are included in the combine. A line of 25,000 Lancashire Electric new ordinary shares came to market at 4s. 6d. premium free of stamp duty. The shares were recently offered at 30s., and are now 11s. paid. The company's old shares stand at 35s. 6d., and carry one additional dividend of about 9½d. per share as compared with the new issue. The iron and steel market is firm as a whole, but Babcocks have fallen 2s. to 48s. 9d. Rubber shares strengthened upon an unexpected announcement that the present quota of 65 per cent. is to be reduced to 60 per cent.

Share List of Electrical Companies

HOME ELECTRICITY COMPANIES.

	Nom.	Dividend 1933.	Dividend 1934.	Price Sept. 24.	Rise or Fall.	Yield p.c. £ s. d.
Bournemouth and Poole	1	15	15	3⅞	—	3 17 5
City of London	1	7½	7½	38/–	—	3 19 0
Clyde Valley	1	7	8	40/–	–1/–	4 0 0
County of London	1	10½	10½	53/–	–1/6	3 19 3
Edmundson's 7% Pref.	1	7	7	35/–	–1/–	4 0 0
Do. Ord.	1	7	8	40/6	–1/–	3 19 0
Elec. Dis. Yorkshire	1	9	9	47/–	—	3 16 9
Elec. Fin. and Securities	1	12½	12½	3¾xd	–1/6	3 14 2
Elec. Supply Corporation	1	11	11	3⅛xd	–⅛	3 11 10
Lancs Light and Power	1	7½	7½	35/6	–6d.	4 4 6
Lond. Assoc. Electric	1	—	—	32/–	–6d.	4 7 6
London Electric	1	7	8	38/6	—	4 3 0
London Power deb. Red.	Stock	5	5	108½	–1	4 12 4
Metropolitan	1	10	10	51/–	–1/6	3 18 6
Midland Counties	1	7	7	35/6xd	–6d.	3 19 0
Mid. Elec. Power	1	8	8	40/9xd	–⅛	3 18 6
North Eastern Electric Ordinary	1	6	6	32/0	–6d.	3 15 0
Do. 7% Pref.	1	7	7	34/6	–1/–	4 1 2
Northampton	1	10	10	51/3	—	3 18 2
Notting Hill 6% Pref.	10	6	6	14½	–½	4 2 9
North Met. Elec. Ordinary	1	10	10	57/6	—	3 9 5
Do. do. 6% Pref.	1	6	6	31/6	–6d.	3 16 2
Scottish Power	1	8	8	38/6xd	–1/9	4 2 6
South London	1	7	7	33/6	–2/–	4 3 7
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	23/6xd	–1/–	6 7 8
Yorkshire Elec.	1	8	8	43/–	–1/–	3 14 5

PUBLIC BOARDS.

Central Electricity, 1950–70	Stock	5	5	115	—	4 7 0
Do. 1955–75	,,	5	5	117	–1	4 5 8
Do. 1951–73	,,	4½	4½	110	—	4 1 10
Do. 1963–93	,,	—	3½	102	–2	3 8 6
London Elec. Trans. Gtd.	,,	—	2½	94	–2	2 13 1
London & Home Counties, 1955–75	,,	4½	4½	114	—	3 19 0
London Passenger Transport, A.	,,	—	4½	122½	–1	3 12 10
Do. do. B.	,,	—	5	127½	—	3 18 9
Do. do. C.	,,	3	—	100	–2	3 0 0
West Midlands Joint Elec. 1948–68	,,	—	5	115	—	4 7 0

TELEGRAPH AND TELEPHONE.

American Tel. & Tel.	$100	9	9	141½	–1	6 7 4
Anglo-Am. Tel. Pref.	Stock	6	6	116	—	5 3 0
Do. Def.	,,	1½	1½	27½	–½	5 9 1
Cable & Wireless 5½% Pref.	,,	2¾	4½	95½	–2	4 6 7
Do. A. 7½% Ord.	,,	Nil	Nil	22	–1	—
Do. B. Ord.	,,	Nil	Nil	6¾	–¼	—
Globe Tel. & Tel. Ord.	10	2½	3½*	13	+½	2 13 10
Do. do. Pref.	10	6	6	13¾	—	4 7 3
Great Northern Tel.	10	20	20	40	—	5 0 0
Marconi-Marine	1	10	7½	32/6	—	4 12 4
Oriental Telephone Ord.	1	12	12	3⅜	—	*3 15 1

HOME AND FOREIGN TRAMS, ETC.

Anglo-Arg. Trams First Pref.	5	Nil	Nil	1/6	—	—
Do. do. 2nd Pref.	5	Nil	Nil	1/6	—	—
Do. do. 5% Deb.	Stock	Nil	Nil	5	—	—
British Electric Traction Df. Ord.	,,	5	5	1050	–25	—
Do. do. Pref. Ord.	,,	8	8	170	–7½	4 14 2
Brazil Traction	100	—	—	8	—	—
Brit. Columbia Elec. Rly. Pce.	Stock	5	5	98½	—	5 1 6
Mexican Light Common	100	Nil	Nil	2½	—	—
Do. 7% Pref.	100	7	7	4½	—	—
Do. 1st Bonds	$500	5	5	35	—	—
Victoria Falls Ord.	1	20	20	3¼	–¼	—
West Riding	1	5	6½	42/–	—	3 2 0

MANUFACTURING COMPANIES.

Aron Electricity Ord.	1	10	15	2⅛	–⅛	5 2 0
Assoc. Elec. Ord.	1	4	6	34/–	–1/–	3 10 7
Do. Pref.	1	8	8	37/6	—	4 5 4
Babcock & Wilcox	1	6	8	48/9	–2/–	3 5 4
British Aluminium Ord.	1	5	7½	41/6	–1/–	3 12 4
British Insulated Ord.	1	5	15	4¾xd	—	3 8 8
Brush Ord.	Stock	Nil	Nil	47½	–2	—
Callender's	1	15	15	3⅜	—	4 2 10
Do. 6½% Pref.	1	6½	6½	32/6	—	4 0 0
Crompton Parkinson Ord.	5/–	—	12½	3⅜	–⅛	0 19 6
Do. 8% Pref.	1	8	8	37/6	—	4 5 4
Edison Swan 1st Pref.	1	7½	7½	27/6	—	5 9 0
Electric Construction	1	Nil	3½	24/3	—	2 17 9
Enfield Cable Ord.	1	25	25	4⅜	–⅛	5 2 6
English Electric	1	Nil	Nil	15/–	–½	—
Do. do. Pref.	1	Nil	Nil	1	–⅛	—
Ericssons Tel.	1	—	24	6½	–½	3 9 7
Ever Ready	5/–	35	35	22/–	—	7 19 0
Ferranti Pref.	1	7	7	28/–	—	5 0 0
G.E.C. Pref.	1	6½	6½	32/6	—	4 0 0
Do. Ord.	1	8	10	3⅛	–⅛	3 5 3
Henley's	1	30	30	6¾	—	4 8 0
Do. 4½% Pref.	5	4½	4½	5⅜	—	3 16 8
India-Rubber Preferred	1	—	5½	1⅜	—	4 17 9
Johnson & Phillips	1	5	7½	41/3	—	3 12 9
Siemens Ord.	1	6½	4	22/6	—	3 11 0
Telegraph Construction	£1	Nil	Nil	22/6	–⅛	—

* Dividends are paid free of Income Tax.

Published Specifications

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings will be taken.

1933

33189. "Instruments for measuring surge currents." British Thomson-Houston Co., Ltd. November 26th, 1932. (434110.)
33494. "Electric converting apparatus." British Thomson-Houston Co., Ltd. December 1st, 1932. (434351.)
35510. "Method of and arrangement for producing image points of defined form in Braun tubes." Radioakt.-Ges. D. S. Loewe, and K. Schlesinger. December 20th, 1932. (434111.)
36424. "Electric circuit-breakers." British Thomson-Houston Co., Ltd. December 29th, 1932. (434114.)

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2253 "Electrolytic processes for descaling, cleaning, or plating metals." S. R. Brewer and J. F. Hinsley. January 23rd, 1934. (434116.)
2839. "Method of, and arrangement for, the television transmission of kinematograph films." Radioakt.-Ges. D. S. Loewe. January 31st, 1933. (434274.)
2867. "Directional radio systems suitable for use for navigation purposes." Marconi's Wireless Telegraph Co., Ltd., and G. A. Mathieu. January 27th, 1934. (434117.)
2922. "Method of connections which effects a delayed release of station protective switches when a non-permissible voltage arises between neutral and earth." Schiele & Bruchsaler-Industriewerke Akt.-Ges., and J. A. Crabtree & Co., Ltd. January 27th, 1933. (434118.)
2923. "Electro-magnetic time relay." Schiele & Bruchsaler-Industriewerke Akt.-Ges., and J. A. Crabtree & Co., Ltd. January 28th, 1933. (434275.)
2985. "Electric-discharge lamps." British Thomson-Houston Co., Ltd., and W. J. Scott. January 29th, 1934. (434276.)
5843. "Electric secondary cells." N. H. Hamilton. February 22nd, 1934. (434417.)
5869. "Electric incandescent lamps." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. March 2nd, 1933. (434123.)
5977. "Step-by-step electrical transmitters." Sperry Gyroscope Co., Ltd., and M. Parker. February 23rd, 1934. (434124.)
6034. "Cathode-ray tube circuit arrangements." Marconi's Wireless Telegraph Co., Ltd., and A. J. Young. February 23rd, 1934. (434199.)
6149. "Synchronising of television apparatus." Radioakt.-Ges. D. S. Loewe. February 25th, 1933. (434278.)
6301. "Variable speed dynamos." C.A.V.-Bosch, Ltd., and W. H. Glaser. February 27th, 1934. (434129.)
6316. "Electro-pneumatic braking apparatus." D. F. Brown and Westinghouse Brake & Signal Co., Ltd. February 27th, 1934. (434131.)
6481. "Telephone apparatus." E. Shipton. February 28th, 1934. (434134.)
6507. "Combined radio receivers and talking machines." Marconi's Wireless Telegraph Co., Ltd., and A. A. Linsell. February 28th, 1934. (434208.)
6576. "Cases for electric storage batteries." J. Lucas, Ltd., and J. Merrick. March 1st, 1934. (434427.)
6763. "Combined induction coils and ringers adapted for use in telephone sets." Standard Telephones & Cables, Ltd., and B. B. Grace. March 2nd, 1934. (434437.)
6878. "Electric plug-and-socket couplings or connectors." Walsall Conduits, Ltd., A. E. Millard, and A. H. Stevens. March 5th, 1934. (434442.)
7500. "Electric kettles and the like." O. J. Wootton. March 9th, 1934. (434445.)
10211. "Automatic circuit-breakers." H. H. Sprigg. February 3rd, 1934. (434282.)
11672. "Electric control apparatus for regulating the load distribution of dynamo-electric machines." Igranic Electric Co., Ltd. April 20th, 1933. (434368.)
14329. "Photographic recording of sound impulses." Radio Corporation of America. June 8th, 1933. (434376.)
15074. "Röntgen-ray apparatus." A. Schulze-Berge. June 30th, 1933. (434148.)
15125. "Electric heating circuits." General Electric Co., Ltd., and M. S. H. Hunt. May 18th, 1934. (434288.)
15851. "Relays for effecting voltage regulation of electric arc rectifiers." General Electric Co., Ltd., and J. W. Gibson. May 28th, 1934. (434293.)
16130. "Telephone systems." Ericsson Telephones, Ltd., and D. C. Crowe. May 30th, 1934. (434446.)
17386. "Electrical signalling systems." B. M. Hadfield. June 12th, 1934. (434448.)
18246. "Electric wave amplifying systems." J. A. Robinson. June 20th, 1934. (434299.)
18373. "Electric remote control systems, such as automatic telephone systems." Siemens Bros. & Co., Ltd., H. E. Humphries and H. J. Edwards. June 21st, 1934. (434300.)
20483. "Dynamo-electric machines." British Thomson-Houston Co., Ltd. July 12th, 1933. (434451.)
23873. "Thermally controlled switching device applicable to electric apparatus." G. Bray & Co., Ltd., and G. Bray. August 18th, 1934. (434453.)
24109. "Electrical measuring instrument." G. B. Stanton. April 7th, 1934. (434385.)
24215. "Automatic pipe or electric couplings for rail and like vehicles." Knorr-Bremse Akt.-Ges. September 2nd, 1933. (434241.)
35204. "Means for voltage regulation in current-converting apparatus." Allmänna Svenska Elektriska Aktiebolaget. December 7th, 1933. (434456.)
35814. "Flash-light lamps." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. December 15th, 1933. (434253.)
35934. "Electric incandescent lamps." P. W. Burke. December 14th, 1934. (434316.)
37079. "High-voltage discharge tubes." C. H. F. Müller Akt.-Ges. January 26th, 1934. (434319.)

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1526. "Electric fittings." B. Becker. January 16th, 1935. (434168.)
2143. "Thermionic valves and circuit arrangements incorporating them." Marconi's Wireless Telegraph Co., Ltd. (J. C. Smith). February 26th, 1934. (Divided out of 6237/34.) (434170.)
2573. "Modulated carrier wave systems." Telefunken Ges. für Drahtlose Telegraphie. January 31st, 1934. (434326.)
6538. "Apparatus for simultaneously starting movable elements located at spaced stations." Electrical Research Products, Inc., and A. D. Dowd. March 3rd, 1934. (434336.)
7399. "Magnetos." R. Bosch Akt.-Ges. March 14th, 1934. (434269.)
7595. "Electrolytic production of beryllium." Deutsche Gold-und Silber Scheideanstalt Vorm. Roessler and Dr. G. Jaeger. March 11th, 1935. (434338.)
10493. "Electric incandescent lamps." General Electric Co., Ltd. April 10th, 1934. (434404.)
12805. "Radio antenna systems." Marconi's Wireless Telegraph Co., Ltd. April 28th, 1934. (434409.)
14747. "Television and like transmitting systems." Marconi's Wireless Telegraph Co., Ltd. May 18th, 1934. (434469.)
15883. "Method of and apparatus for controlling motors of electrically driven vehicles." A. W. Maley and E. M. Taunton. August 17th, 1934. (Divided out of 23809/34.) (434189.)
16486. "Sound-wave apparatus." British Thomson-Houston Co., Ltd. June 6th, 1934. (434413.)
21336. "Electric telegraph message transmission systems." E. E. Kleinschmidt. January 5th, 1933. (Divided out of 32317/33.) (434190.)

Trade Mark Applications

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from September 18th:—

Andise (lettering and design). No. 560964. Class 8. Portable radio receiving sets.—A. C. Alexandra & Co., Buchanan Buildings, 24, Holborn, E.C.1.

Microdyne. No. 562266. Class 11. Electric contrivances (not medicated) for surgical or curative purposes.—Cecil Ryder Oliver, 61, Courtfield Gardens, S.W.5.

Mouldrite. No. 552042. Class 40. Synthetic resins and condensation products of urea-formaldehyde, of phenol-formaldehyde and of polymerisable unsaturated organic bodies, all sold in the form of moulding powders.—Mouldrite, Ltd., Aldwych House, Aldwych, W.C.2.

The electrical pile-driving plant mentioned on page 420. Left: The generating plant. Right: The electric motor and winch in the frame

New Work for Contractors

Particulars of new works and building schemes for the use of electrical installation contractors and traders

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Abercarn.—Cinema; Howard Williams, architect, Cardiff.

Aberystwyth.—Residential flats, Main Road, Trefechan; D. T. Jones, architect.

Arlesey (BEDS).—Nurses' home at the Three Counties Hospital; Parrot & Dunham, architects, 9, George Street West, Luton.

Baldock (HERTS).—Houses (250), London Road estate; H. Gentle.

Barnstaple.—Church, Hele Manor, for the Methodist trustees; secretary.

Bedfordshire.—School, Shefford, for the county E.C.; director of education for the county, Bedford.

Birmingham.—Block of residential flats, Goodby Road (electrical work); J. Bowen & Son, builders, Balsall Heath.

Billinge & Winstanley (LANCS).—Houses (60), Birchley Road; U.D.C. surveyor.

Boston.—Waterworks pumping station, Fordington, for the Council (£6,244), with electrical work; Walter Firth, Ltd., builders, Doncaster.

Bovey Tracey (DEVON).—Roman Catholic church; priest-in-charge.

Bradford.—Houses (330), Apperley Lane and Mitchell Lane; T. Obank. Grammar school, Leaventhorpe; city architect.

Cardiff.—Extensions to St. Illtyd's College (£10,000); city surveyor.

Carlisle.—Extensions to Messrs. Binns' drapery premises, English Street; H. Foxall, architect, Lowther Street.

Cheadle (STAFFS).—Council chamber and public offices (£11,000), for the R.D.C.; F. S. Cox, clerk.

Cowdenbeath.—Houses (126), for the Council; burgh surveyor.

Darlington.—Houses, Mowden estate, for Lloyds Bank, Ltd.; J. E. Chilton, architect, Tubwell Row. Alterations to premises, King Street, for Tees-side Farmers, Ltd.; H. B. Richardson, architect, 3, Skinnergate.

Dingwall (ROSS-SHIRE).—Academy (electrical work) for Ross & Cromarty C.C.; D. Matheson & Sons, architects.

Dumfries.—Business stores, High Street, for Prices Tailors, Ltd., Leeds.

Durham.—R.C. senior school (200 places), Springwell Hall; city E.C.

Essex.—School, Chadwell Heath; county architect, Chelmsford.

Faversham (KENT).—R.C. church, Tanner Street; priest-in-charge, Plantation Road.

Gillingham (KENT).—Rebuilding electrically equipped bakery; C. Moakes, Ltd.

Glasgow.—Houses (32), Wykeham Road, Scotstounhill; R. Shaw, builder, 326, Byres Road.

Grantham.—Houses (106); Read Bros., builders.

Halifax.—Houses, Beacon Hill Road; borough engineer.

Hamilton.—Houses (58); burgh surveyor.

Hampshire.—Secondary school, Farnborough; county architect, The Castle, Winchester.

Harrow.—Church, St. Alban's parish; A. W. Kenyon, architect, Welwyn Garden City.

Hassocks (SUSSEX).—Estate development (1,600 houses); secretary, Sussex Homes, Ltd.

Hemsworth (YORKS).—Houses (46), Ackworth, for the R.D.C.; Glew Bros., builders, Royston.

Hertford.—Houses (28), Hertford Heath; R.D.C. surveyor. Housing estate development, Ware Road (electrical work); Avis & Brooker, builders, Hertingfordbury.

Heston & Isleworth.—Junior school (400 places), Cranford Lane; education secretary.

Ipswich.—Reconstruction of premises; Ransomes, Sims & Jefferies, Ltd.

Irish Free State.—(KILKENNY).—Labourers' cottages (341) for County Board and Health and Public Assistance; T. Kelly, consulting engineer, 35, Patrick Street. (SLIGO).—Electrical installation and other work at the mental hospital; McAteer & McEntee, consulting engineers, 9, Dawson Street, Dublin. (OFFALY).—County Hospital, Tullamore, for the Board of Health and Public Assistance of Birr, County Offaly; Scott & Good, architects, 36, South Frederick Street, Dublin. (KILDARE).—Technical school, Castledermot, for the County Kildare Vocational Education Committee, Naas; J. O'Gorman, architect, 11, Leinster Street, Dublin.

Kent.—Schools, Hirst, Bexley, for County E.C.; R. Corben & Co., Ltd., builders, Maidstone. Schools, Warren Road, Orpington, and Footscray Lane, Sidcup; County architect, Maidstone. Improvements to County school for girls, Folkestone, for County E.C.

Kidderminster.—Extensions to warehouse, Green Street; T. & A. Naylor, Ltd. Block of flats, Comberton; Kidderminster Development, Ltd.

Kirkcaldy.—Fire station (£14,500); burgh surveyor.

Leamington Spa.—G.W.R. station buildings, Warwick Road (£50,000), with electrical work; Survey Dept., G.W.R., Paddington, London.

Littlehampton.—Alterations to 11, Surrey Street; Sussex Elec. Supply Co., Ltd.

Liverpool.—R.C. Church, Heath Road, Allerton (£6,000), with electrical work; priest-in-charge.

London.—(DEPTFORD).—Alterations to Distillery building, Deptford Bridge; Yates, Cook & Darbyshire, architects, 43, Great Marlborough Street, W.1. (LEWISHAM).—Bazaar stores, Rushey Green; F. W. Woolworth & Co., Ltd., 1, New Bond Street, W.1. (STOKE NEWINGTON).—Flats, Woodberry Down and Seven Sisters Road; F. Dod & Co., 39, Stamford Hill, N.16. Flats, 250, Green Lanes; H. Kelsall Armitage, architect, 8, Blenheim Street, W.1.

Lowestoft.—Houses (44), Somerton Avenue; Warnes & Sons.

Manchester.—Houses (120), Briscoe Lane, Newton Heath; city architect.

Newcastle-on-Tyne.—Cinema, Forest Hall, for E. J. Hinge; W. Willson, Ltd., builders, Cemetery Road, Gateshead.

Newmilns (AYRSHIRE).—Houses (182), Gilfoot site, for the Council; burgh housing architect.

Newquay.—Rebuilding of Pavilion Cinema (£40,000); Cowell, Drewitt & Wheatley, architects, Truro.

Nottingham.—Waterworks (£40,000); city engineer.

Nottinghamshire.—Schools at Netherfield and Selston; director of education for county; Nottingham.

Oldham.—Houses (162), Stoneleigh Hall estate; borough surveyor.

Ongar (ESSEX).—Houses (64); R.D.C. surveyor.

Paignton.—Houses (22), Collaton Estate (£6,000); Lewis & Wills. Houses (23), Preston Down Road; L. Chadwick.

Penrith.—Houses (50), Penny Hill; P. A. Baines & Sons, Kendal.

Prescot.—Houses (500), Shaw Lane; F. A. Gregson, surveyor.

Reading.—School, Caversham; education architect.

Renfrewshire.—School, Houston; County clerk, County Buildings, Paisley.

Retford.—Houses (78), Ordsall, for the T.C.; Martlew & Bell, builders.

Richmond (YORKS).—Town hall (£15,000); borough surveyor.

Ripon.—Bus station; city engineer.

Royston (YORKS).—Houses (36), Cross Lane; U.D.C. surveyor.

Royton.—Electric lighting and power installation to houses, Stottfield estate; U.D.C. surveyor.

Saddleworth (LANCS).—Houses (79), Carrcote Delph; U.D.C. architect.

Scarborough.—Houses (82), Cross Street area; borough engineer. Factory, Seamer Road; F. W. Plaxton.

Sedgley.—Stores, Wolverhampton Road; Dudley Co-operative Society, Ltd.

Shoreham (SUSSEX).—Houses, Holmbush estate; U.D.C. surveyor.

Sautham (WARWICKSHIRE).—Houses (24), Harbury, for the R.D.C.; Quick & Lee, architects, 11, Waterloo Place, Leamington.

Southampton.—Institution, with nurses' home, Westend, for the P.A.C.; S. G. Stanton, architect.

Stanford-le-Hope (ESSEX).—Church, Central Road, for the Methodist trustees; C. W. Hawkins.

Stratford-on-Avon.—Pumping station, Birmingham Road: J. D. & D. M. Watson, engineers, 3, Central Buildings, Westminster, London, S.W.1.

Sunderland.—Extensions to hospital, for the T.C.; W. Morton, quantity surveyor, John Street. Houses on 102 acres of land near Barnes Burn and others near Durham Road; borough engineer. Remodelling of Moor Council School; Allen & Hill, quantity surveyors, 27, Frederick Street. Alterations to Royal Infirmary, Park Burn Road; R. Hudson & Sons, builders, St. Mark's Crescent. Houses at Newham Avenue and Broadsheaf Road; W. and T. R. Milburn, architects, 17, Fawcett Street.

Surbiton.—Station (£150,000), for the Southern Railway Co.; chief engineer.

Swansea.—Extensions to Gorse Road schools (£15,000); director of education. Hall, Northumberland Place; Transport Workers' Union. Houses (44) off Lon Coed Bran; Rogers & Davies. Houses at Gower Road and Martell Street; T. & G. Spragg, Ltd. Shops and offices, Park Street and Heathfield Street; S. Stride.

Swinton and Pendlebury.—Stores, demonstration room, workshop, &c., for the Electricity Department; J. Knight, architect.

Tilbury (ESSEX).—Five-storey factory, canteen, dormitories, &c.; Bata Shoe Co. (British), Ltd.

Twickenham.—Flats (42) at St. Margaret's (electrical work); Perry's (Ealing), Ltd., builders, London, W.5.

Wallasey.—News cinema, dance hall, restaurant and rink; E. Berry Webber.

Walthamstow.—School, Hale End Road (£8,840); director of education.

Walton-on-Thames.—Station, Hersham, for the Southern Railway Co.; chief engineer.

Warrington.—Houses (60), near Liverpool Road, Penketh; R. & H. Fletcher, Ltd., builders, Victoria Chambers, Cleveleys, Blackpool.

Wellingborough.—Church hall, Doddington Road (electrical work); C. Adams & Co., Finedon Road.

Wembley.—Cinema (2,000 seats), Ealing Road; Associated British Cinemas, Ltd., 30, Golden Square, London, W.1.

Westbury (WILTSHIRE).—Houses (24); F. J. Finch, U.D.C. clerk.

West Riding.—Senior school, Ash Hill, Hatfield; director of education, Wakefield.

Whitehaven (CUMBERLAND).—School (500 places), Kells; director of education.

Whiston.—Houses (58), Rainhill, for H. Huyton & Son.

Wincanton.—Houses (48), Shepton Montague; R.D.C. surveyor.

Witham (ESSEX).—Houses (40); U.D.C. surveyor.

Woking.—Remodelling station (£200,000), for the Southern Railway Co.; chief engineer.

Wombwell (YORKSHIRE).—Houses (54); Howarth & Everatt, builders.

Worsley (LANCS).—Clothing factory, Walkden, for Montague Burton, Ltd., Hudson St. Mills, Leeds.

Worthing.—Church hall (£3,400), with electrical work; Rowlands Bros., builders, Horsham. Houses (20), Loose Lane, Sompting; R.D.C. surveyor, 15, Mill Road.

Wymondham (NORFOLK).—Houses (20); U.D.C. surveyor. Post Office, Priory Meadow, for H.M. Office of Works, King Charles Street London, S.W.